4. ENVIRONMENTAL CONSEQUENCES

4.1 PROPOSED ACTION

The proposed action is for DOE to provide cost-shared funding for the design, construction, and demonstration of the proposed facilities to produce electricity, steam, and liquid fuels from anthracite culm by integrating coal gasification and Fischer-Tropsch synthesis of liquid hydrocarbon fuels. During the 3-year demonstration period, the plant would be operated at an 85% capacity factor. DOE's role would be to collect operating and environmental data on the integration of the technologies. The following sections discuss the potential environmental consequences of constructing the facilities and operating them during the demonstration period.

4.1.1 Land Use and Aesthetics

4.1.1.1 Land Use

The proposed main plant would be confined to the area between the existing Gilberton Power Plant and the Mahanoy State Correctional Institution, and thus would not affect offsite land use. The ancillary facilities would not affect offsite land use due to their small size (i.e., a few acres) and location adjacent to ancillary facilities for the existing power plant. As with the Gilberton Power Plant, the proposed facilities would be consistent with existing land use plans and local zoning. The limited in-migration of workers required for plant construction and operation would not increase offsite land use for residential purposes (Section 4.1.7.3).

The culm that would be used as feedstock for the proposed facilities would be obtained from culm banks *deposited* during previous anthracite mining in the region. Following culm removal from lands in the adjacent valley and the region, these lands would be graded to minimize erosion and revegetated. Although a reasonable estimate cannot be made of the amount of land that would be reclaimed during the 3-year demonstration period (because of uncertainty in the selection of culm banks to be used and variations in bank dimensions), *it is estimated that* approximately 1,000 acres would be reclaimed over the *first half of the 50-year* operating life of the proposed facilities.

4.1.1.2 Aesthetics

As part of the proposed facilities, five 200-ft stacks and one 300-ft stack would be constructed. The five 200-ft stacks would be considerably shorter than the existing 326-ft stack at the adjacent Gilberton Power Plant, and the 300-ft stack would be slightly shorter. In addition, *there would also be five baghouse stacks, one stack for the emergency main flare, one stack for an emergency engine, and one stack for a carbon adsorption unit. These stacks would be smaller than the 200-ft stacks.* The new gasifier and turbine buildings would be similar in size to the existing power plant buildings. Consequently, the proposed facilities would appear as an extension of the existing industrial character of the locale rather than as an appreciable change in character. Depending on the

viewpoint, other power plants, strip mines, and culm piles could also be visible (Section 3.1). Topography and vegetation would contribute in some locations to the visual screening of the proposed facilities.

As with the Gilberton Power Plant (Section 3.1), stack emissions and cooling tower plumes from the proposed facilities would occasionally be visible. Under most meteorological conditions, the atmosphere would be unsaturated and would provide enough mixing so that the water vapor from the cooling towers would not condense. However, during meteorological conditions when the atmosphere is nearly saturated, winds are light, and mixing is very low (i.e., during some early morning hours), condensation is possible, which would appear in the form of a cooling tower plume and/or fog (Section 4.1.2.2).

The Federal Aviation Administration would regulate the marking and lighting of temporary and permanent structures associated with the proposed facilities (Section 7.1). Generally, construction cranes and other elevated equipment require lighting if their height above the ground exceeds 200 ft. The 300-ft stack and perhaps the 200-ft stacks would require medium- or high-intensity flashing white obstruction lights. The lights would operate at reduced intensity during the night. Because this type of lighting is currently installed and operating on the Gilberton Power Plant's stack, the additional lighting would be consistent with the area's industrial appearance.

In summary, because the visual landscape of the area is already conspicuously marked with industrial structures (Section 3.1), the proposed facilities would not alter the industrial appearance of the site and, accordingly, would not degrade the aesthetic character of the area.

4.1.2 Atmospheric Resources and Air Quality

This section evaluates potential impacts to atmospheric resources that could result from construction and operation of the proposed facilities. Section 4.1.2.1 discusses effects of construction, including fugitive dust associated with earthwork and excavation. Section 4.1.2.2 discusses operational effects, including from emissions of criteria and hazardous air pollutants, regional-scale acidic deposition, and global climate change.

4.1.2.1 Construction

During construction of the proposed facilities, temporary and localized increases in atmospheric concentrations of NO_x, CO, SO₂, VOCs, and particulate matter would result from exhaust emissions of workers' vehicles, heavy construction vehicles, diesel generators, and other machinery and tools. *An estimated 500 vehicles would transport workers to and from the site during the 6-month peak construction period (Section 4.1.7.8). Onsite*, an average of about 50 vehicles ranging from passenger vehicles to earthmovers would be used for construction activities, with a peak of about 75 vehicles. Construction vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. These emissions would be very small compared to regulatory thresholds typically used to determine whether further air quality impact analysis is necessary [such as 40 CFR Part 93.153(b)].

Fugitive dust would result from clearing, excavation, and earthwork. Most of this work would occur at the 75-acre main plant site. Minor clearing and grading activities would occur at the approximately 1-acre site of the new beneficiation plant (or expansion of the existing facility) in the adjacent valley to the north of the main plant area and in new 12-ft wide corridors to accommodate conveyors and pipelines (Section 2.1.5.1). After completion of the initial earthmoving operations, gravel would be spread on the main access roads to mitigate further dust generation. Near the end of the construction period, these roads would be paved to minimize dust generated on the site by vehicular traffic.

The impacts of fugitive dust on offsite ambient air concentrations of particulate matter less than 10 µm in aerodynamic diameter (PM-10) were modeled using the EPA-approved SCREEN3 air dispersion model, which is a single-source Gaussian plume model that predicts maximum groundlevel concentrations downwind from point, area, flare, and volume sources (EPA 1995a). SCREEN3, a screening version of the ISCST3 model, provides conservative results (forming an upper bound) using a full range of 54 potential meteorological conditions (i.e., conditions representing different combinations of atmospheric stabilities and wind speeds). This screening meteorological data set typically results in appreciably greater modeled concentrations compared to modeled concentrations using actual meteorological data, which are not available at the proposed site or a nearby representative location (Section 3.2.1). The SCREEN3 model was run using flat terrain, which is conservative for a non-buoyant ground-level source, such as fugitive dust generated during earthwork. Conversion factors (also called multiplying factors) were used to adjust the maximum 1hour concentrations predicted by SCREEN3 to 24-hour and annual averages (EPA 1992), as required for comparison with PM-10 standards (Section 3.2.2). In addition, interpolation between the 8-hour conversion factor of 0.7 and the 24-hour conversion factor of 0.4 was used to obtain a conversion factor of 0.6 for the 13-hour exposure period described below.

The temporary impacts of fugitive dust from construction activities on offsite particulate concentrations would be localized because of the relatively rapid settling of larger-size fugitive dust particles. An average emission factor of 1.2 tons of total suspended particulate matter per acre per month was assumed (EPA 1985). Of these emissions, roughly 30% of the mass would consist of PM-10 (Kinsey and Cowherd 1992). To minimize fugitive dust emissions, water spray trucks would dampen exposed soil with water as necessary, which was assumed would reduce fugitive dust by 50% (EPA 1985). Because construction on the 75-acre main plant site would be staggered, the maximum area undergoing heavy earthwork at any one time *would* be *less than 75* acres.

The total concentrations, obtained by adding maximum modeled concentrations (adjusted by the conversion factors) to their corresponding background concentrations, were compared with the NAAQS (Section 3.2.2). The background concentrations used (i.e., $60 \mu g/m^3$ for the 24-hour averaging period and $24 \mu g/m^3$ for the annual average) were recorded in 2005 at the nearest PM-10 monitoring station, located in Reading (Section 3.2.2). Consequently, the maximum modeled 24-hour concentration should not exceed $90 \mu g/m^3$ because when it is added to the $60 \mu g/m^3$ background concentration, the sum should not exceed the NAAQS of 150 $\mu g/m^3$ [$90 \pmod{100}$ (background)

=150 (total)]. Similarly, the maximum modeled annual concentration should not exceed $26 \mu \text{g/m}^3$ because when it is added to the $24 \mu \text{g/m}^3$ background concentration, the sum should not exceed the NAAQS of 50 $\mu \text{g/m}^3$ [26 (modeled) +24 (background) =50 (total)].

Concentrations were modeled at locations along or outside the WMPI property boundaries, including the neighboring Mahanoy State Correctional Institution. At the prison, the analysis assumed that an individual could continuously be exposed to pollutants in the outside air, except for limiting an individual's outside exposure to fugitive dust from proposed construction activities to a maximum of 13 hours during a 24-hour period (Edward K. Beleski, Mahanoy State Correctional Institution, Local President of Pennsylvania State Corrections Officer Association, personal communication to Robert L. Miller, ORNL, March 22, 2006).

The windows of the 28 buildings on the Mahanoy State Correctional Institution campus are closed. The ventilation systems mix recycled air with outside air when outside air temperatures range between 45 and 75°F. These ventilation systems include anti-microbial filters placed downstream of the air mixing chambers (Ken Mumma, Mahanoy State Correctional Institution, Facility Maintenance Manager, personal communication to Robert L. Miller, ORNL, March 16, 2006). The filters are changed monthly. Consequently, exposure to fugitive dust inside the buildings from construction activities would be negligible. An individual could be exposed to the outside air for as long as 13 hours per day.

Based on the above assumptions, modeling results indicated no exceedances from construction activities, except possibly at the Mahanoy State Correctional Institution, depending on the amount of acreage undergoing heavy earthwork simultaneously. Results indicated that the maximum area undergoing heavy earthwork at any one time would need to be limited to 2.5 acres of the 75-acre main plant site to stay within ambient air quality standards at all locations, including the prison.

The Pennsylvania Department of Environmental Protection has recently installed a PM-10 monitor at the prison to measure ambient concentrations of particles, including fugitive dust (Section 3.2.2). The monitor began operating on May 9, 2006, and the data are available from the Department by request. If the monitor indicates that ambient air quality standards are being exceeded during construction, WMPI has agreed to lessen the intensity of the heavy earthwork to prevent future exceedances.

Actual concentrations would likely be less than predicted because of the conservative assumptions, including linking worst-case meteorological conditions (occurring during the nighttime) with the emission factor described above. Actual emissions during these nighttime meteorological conditions would be considerably less because no machinery would be operating and because of the low wind speed (about 2 miles per hour) associated with worst-case meteorological conditions, which would minimize exposed soil from becoming airborne.

A similar modeling analysis was not conducted for the impacts of fugitive dust on offsite ambient air concentrations of *particulate matter less than or equal to 2.5 \mu m in aerodynamic diameter* (*PM-2.5*). The annual PM-2.5 background concentration of 17 $\mu g/m^3$ recorded in 2005 at the closest monitoring station, located in Reading (Section 3.2.2), exceeded the NAAQS of 15 $\mu g/m^3$, but

Schuylkill County is designated as a PM-2.5 attainment area (Section 3.2.2). Consequently, the Reading monitoring station is not an accurate indicator of existing PM-2.5 concentrations in Schuylkill County, which has no monitoring station. However, as with PM-10 concentrations, PM-2.5 concentrations from fugitive dust emissions would be expected to exceed the NAAQS near the edge of the disturbed area, but decrease to within the NAAQS in a short downwind distance. Because the PM-2.5 concentrations at the Reading monitoring station are greater than expected in Schuylkill County, PM-10 concentrations are also likely to be greater in Reading than in Schuylkill County, which is another indication that the PM-10 modeling analysis using Reading ambient air data is conservative.

During site preparation, open burning of cleared trees and other vegetation would be conducted to reduce or eliminate the amount of vegetation requiring removal off the site (Section 4.1.8). Open burning would not be conducted during drought conditions in which advisories have been issued by the Pennsylvania Department of Environmental Protection. Non-hazardous construction waste would also be burned. Particulate emissions generated during burning would be temporary and intermittent. Open burning would be subject to the requirements of Mahanoy Township Ordinance 2006-3, known as the Mahanoy Township Burning Ordinance, which regulates and restricts outdoor fires. The fire chief would be notified prior to each open-burning event.

On March 18, 2005, the Pennsylvania Department of Environmental Protection issued Air Quality Program Permit No. 54-399-034 for the proposed facilities. The permit, which expires on March 31, 2010, addresses open burning during preparation of the proposed site. Specifically, the permit states that open burning of cleared trees and other vegetation may not be visible outside the property, malodorous air contaminants may not be detectable outside the property, and emissions may not cause harm to human or animal health, vegetation, or property.

4.1.2.2 Operation

This section discusses potential air quality impacts resulting from operation of the proposed facilities. Based on a plant operating rate of 7,500 hours per year (an 85% capacity factor), air emissions from the proposed facilities would total less than 100 tons per year for each of the criteria pollutants (Section 2.1.6.1). Plant-wide SO₂ emissions from the proposed facilities would be about 29 tons per year, NO_x emissions would be about 70 tons per year, particulate emissions would be about 23 tons per year, and CO emissions would be about 54 tons per year. Volatile organic compound (VOC) emissions would be about 28 tons per year (see footnote b of Table 2.1.1 for potential-to-emit annual emissions included in the air permit application submitted to the Pennsylvania Department of Environmental Protection). As a measure of the magnitude of the expected emissions, a source (i.e., the proposed facilities) with potential emissions under the threshold of 100 tons per year for a specific pollutant would not be considered a major stationary source of that pollutant, as defined by the Clean Air Act's Prevention of Significant Deterioration (PSD) regulations (40 CFR Part 51.166). Because the proposed facilities would be considered a minor

new source of all regulated pollutants by the Pennsylvania Department of Environmental Protection, no modeling is required for regulatory applications.

Air Quality Program Permit No. 54-399-034, issued by the Pennsylvania Department of Environmental Protection for the proposed facilities, establishes maximum allowable limits for total facility emissions during any consecutive 12-month rolling period: 99.9 tons for SO_2 , 99.9 tons for NO_x , 99.9 tons for PM-10, 99.9 tons for CO, and 49.9 tons for VOCs. The permitted limits, which are intentionally slightly larger than the expected emissions, function as a cap to ensure that the proposed facilities would be a minor new source of all regulated pollutants.

Emissions of air pollutants would be discharged primarily from five 200-ft stacks located in the main plant area. The stacks would be associated with the heat recovery steam generator (HRSG), the F-T product work-up area (2 stacks), the thermal oxidizer, and the tank-truck loading area. The HRSG stack would emit the most NO_x (43 tons per year), particulate matter (21 tons per year), and CO (31 tons per year). The thermal oxidizer stack would emit the most SO₂ (17 tons per year), and the concentrated CO₂ stream from the Rectisol unit. Infrequently, a 300-ft emergency stack would flare quenched, raw synthesis gas from the gasifier during start-ups and during unexpected shutdowns, such as during loss of power or loss of cooling water. Due to the expected effectiveness of the gas cleanup system, if petroleum coke were to be used as part of a blended feedstock to the gasifier, air emissions would not be significantly affected by feedstock composition (Appendix G), and air emissions would be expected to remain within the permitted levels.

Sources of air pollutants other than stacks would include plant vehicular traffic and personal commuter vehicles. Approximately 50 vehicles ranging from passenger vehicles to tanker trucks would be used during operations on the site. These vehicles would be equipped with standard pollution-control devices to minimize emissions, which would be very small compared to regulatory thresholds typically used to determine whether further air quality impact analysis is necessary [such as 40 CFR Part 93.153(b)]. The small amount of traffic would not contribute appreciably to ambient air pollutant concentrations in the area. Additional particulate matter would be generated from handling and transfer of anthracite culm, petroleum coke, limestone, and process wastes and byproducts. To reduce these particulate emissions, the number of handling and transfer points would be minimized, the conveyors and material loading and unloading points would be enclosed, and wetting systems and collection devices (e.g., baghouses) would be installed.

Predicted Concentrations of Criteria Pollutants

The ISCST3 atmospheric dispersion model (EPA 1995b) was used to estimate maximum increases in ground-level concentrations of SO₂, NO₂, PM-10, and CO. The analysis conservatively included emissions from all 5 process stacks operating simultaneously. Because exact stack locations within the main plant area have not yet been determined, the center of each appropriate process area

¹ The SCREEN3 model was not used because it is limited to simulating atmospheric transport and dispersion of air emissions from a single source.

(e.g., tank-truck loading area) was used for the stack coordinates. Maximum potential hourly emissions and a 100% capacity factor were used in the modeling. All particulate emissions were conservatively assumed to be less than or equal to $10 \mu m$ in aerodynamic diameter (PM-10) for comparison with the standards. Initially, all NO_x emissions were conservatively assumed to be in the form of NO₂ for comparison with the standard.

Because no *quality-assured* wind data have been archived from a location near enough to be representative of the proposed site (Section 3.2.1), maximum concentrations were calculated for the same full range of 54 potential meteorological conditions used by the SCREEN3 model (*Section* 4.1.2.1). The ISCST3 model was run for each of these meteorological conditions for each of 360 wind directions (at 1° compass intervals). Concentrations were modeled at over 30,000 locations (receptors) along or outside the WMPI property boundaries at a spacing of 650 ft and 1° compass intervals at distances of up to 12 miles from the main plant area, as well as for specified receptors along nearby public roads. Topography was included in the modeling. Because the height of the proposed stacks would be at least 2.5 times the height of the buildings in the main plant area (i.e., Good Engineering Practice stack height), wake effects from building downwash were not considered. Due to the absence of representative *quality-assured* wind data, *multiplying* factors were used (as in Section 4.1.2.1) to adjust the maximum 1-hour concentrations predicted by ISCST3 to 3-hour, 8-hour, 24-hour, and annual averages (EPA 1992) to facilitate comparison with applicable averaging periods for SO₂, NO₂, PM-10, and CO standards (Section 3.2.2).

In this analysis, "significant impact levels" were used to measure the significance of the maximum predicted concentrations (EPA 1990). The significant impact levels are much more stringent than the NAAQS (Table 3.2.1) and PSD Class II increments (Table 3.2.2), and even more stringent or the same as the PSD Class I increments (Table 3.2.2). According to EPA guidelines (EPA 1990), a preliminary modeling analysis using significant impact levels should include only the emissions associated with the proposed facilities to determine if the facilities would have a significant impact on ambient air quality. If the maximum predicted concentrations are less than the significant impact levels, additional modeling including other sources and background concentrations is not required (EPA 1990).

Modeling results indicated that maximum concentrations are predicted to be less than their corresponding significant impact levels, with the exception of the annual NO₂ concentration, which has a value of 1.1 μ g/m³ versus a significant impact level of 1 μ g/m³ (Table 4.1.1). However, NO_x emissions are composed of both NO emissions and NO₂ emissions, and not all NO emissions convert to NO₂ in the atmosphere. Consequently, the analysis was refined by relaxing the initial conservative assumption that all NO_x emissions were in the form of NO₂. EPA's Guideline on Air Quality Models (40 CFR Part 51, Appendix W) recommends an approach using the ambient ratio method with a NO₂-to-NO_x ratio of 0.75 (the annual national default ratio) to more accurately predict ambient NO₂ concentrations in the area of concern. Using this approach, the revised maximum annual NO₂ concentration was predicted to be 0.8 μ g/m³, which is less than its significant impact level of 1 μ g/m³. Therefore, additional modeling including other sources and background concentrations was not

required *for regulatory purposes* for any of the pollutants. *Nevertheless, potential cumulative impacts including existing sources and background concentrations have been evaluated in Section 6.1.1.* Because of the conservative assumptions used in the analysis, actual degradation of air quality should be even less than the small amounts predicted.

Maximum concentrations for all pollutants were predicted to occur at the same location on top of Locust Mountain, an undeveloped forested area slightly over 3 miles north of the main plant area and immediately northeast of Shenandoah. Concentrations at other locations, including the nearby Mahanoy State Correctional Institution, would be less. Concentrations would be negligible at the nearest PSD Class I area, about 130 miles to the southeast (Section 3.2.2), because dispersion of pollutants at that distance would reduce atmospheric concentrations to a small fraction of the maximum modeled concentrations, which are predicted to be less than PSD Class I increments at the location of their maximum impact on Locust Mountain.

No significant impact levels or PSD increments currently exist for PM-2.5. However, assuming conservatively that all PM-10 emissions *would be small enough to be* PM-2.5 *emissions*, the maximum *predicted* 24-hour concentration of 0.8 μ g/m³ (*Table 4.1.1*) would be only 2% of the corresponding 24-hour PM-2.5 NAAQS of 35 μ g/m³ (Table 3.2.1). Similarly, the maximum *predicted* annual concentration of 0.2 μ g/m³ (*Table 4.1.1*) would be about 1% of the corresponding *annual PM-2.5* NAAQS of 15 μ g/m³ (Table 3.2.1). These small percentages would not be expected to result in violations of the PM-2.5 NAAQS, for which Schuylkill County is in attainment (Section 3.2.2).

Table 4.1.1. Maximum predicted air pollutant concentrations from proposed project operations compared to National Ambient Air Quality Standards (NAAQS), allowable increments for Prevention of Significant Deterioration (PSD) of air quality, and significant impact levels.

Pollutant	Averaging period	Maximum predicted concentrations	$NAAQS$ $concentration^a$ $(\mu g/m^3)$	PSD allowable increment ^a (µg/m³)		Significant impact level (µg/m³)
		$(\mu g/m^3)$	(μ ₆ /m)	Class I ^b	Class II ^c	
Sulfur dioxide (SO ₂)	3-hour	10.6	1,300	25	512	25
	24-hour	4.7	365	5	91	5
	Annual	0.9	80	2	20	1
Nitrogen dioxide (NO_2)	Annual	1.1 (initial) 0.8 (revised)	100	2.5	25	1
Carbon monoxide	1-hour	11.4	40,000	-	-	2,000
(CO)	8-hour	8.0	10,000	-	-	500
Particulate matter less than 10 µm aerodynamic diameter (PM-10)	24-hour	0.8	150	8	30	5

^a See Tables 3.2.1 and 3.2.2 for additional information.

^b Class I areas are specifically designated areas in which the degradation of air quality is to be severely restricted.

^c Class II areas (which include most of the United States) have a less stringent set of allowable increments.

No appreciable *lead* (Pb) emissions would occur from operation of the proposed facilities. Concentrations of Pb in recent years have been well below NAAQS, largely because of the decreased use of leaded gasoline in automobiles. Therefore, Pb emissions from the proposed facilities are not evaluated further.

Ozone (O₃) is not emitted directly from a combustion source but is formed from photochemical reactions involving emitted VOCs and NO_x. Because the reactions involved can take hours to complete, O₃ can form far from the sources of its precursors (the VOCs and NO_x that initiate its formation). Therefore, the contribution of an individual source to O₃ concentrations at any particular location cannot be readily quantified. Stack emissions of NO_x from the proposed facilities would be about 70 tons per year, which would be less than 1% of Schuylkill County's NO_x emissions inventory of 8,335 tons per year in 1999, the latest year with an available inventory. Stack VOC emissions would be about 28 tons per year, which would be less than 0.4% of the county's VOC emissions inventory of 7,840 tons per year in 1999. Because the nearest O₃ monitoring station is located in Reading, about 35 miles south-southeast of Gilberton (Section 3.2.2), existing ambient O₃ concentrations in the area are uncertain. The small percentage increases in NO_x and VOC emissions would not be likely to degrade O₃ concentrations sufficiently to cause violations in the O₃ NAAQS, but the magnitude of the degradation cannot be quantified.

Conformity Review

Schuylkill County is in attainment with NAAQS and state ambient air quality standards for all criteria pollutants (Section 3.2.2). Further, Schuylkill County has not been designated by the EPA as being in a maintenance area for any pollutant (an area that previously was a nonattainment area, which is striving to maintain attainment and comply with the state implementation plan). Consequently, the proposed action is exempt from General Conformity requirements (i.e., the action's air emissions would not occur in an area subject to a conformity review).

Hazardous Air Pollutants

Trace emissions of other pollutants would include mercury, beryllium, sulfuric acid mist, hydrochloric acid, hydrofluoric acid, benzene, arsenic, and various heavy metals. As required by the F-T synthesis process, the synthesis gas would be cleaned extensively using wet scrubbing followed by acid gas removal using a Rectisol unit, prior to sending the gas to the F-T synthesis facilities and the combined-cycle power plant. Therefore, a high percentage of hazardous air pollutants and trace elements in the synthesis gas would be removed. Part of the purpose of the proposed project is to generate environmental data, including hazardous air pollutant measurements, from the operation of the integrated technologies at a sufficiently large scale to allow industries and utilities to assess the project's potential for commercial application (Section 1.4).

Emissions of hazardous air pollutants (e.g., mercury) from the proposed facilities would likely be very similar to emissions from state-of-the-art integrated gasification combined-cycle facilities due to the similarity in the technologies, including synthesis gas cleanup equipment. Extensive

characterization of trace elements during demonstration of a Shell pilot-scale integrated gasification combined-cycle plant from 1987 to 1991 indicated that scrubbing in the synthesis gas cleanup train, upstream of the acid gas removal equipment, was very effective in removing volatile trace elements (SAIC 2002). Volatile trace elements were not detected in the clean product synthesis gas or the acid gas, with the exception of lead in the clean synthesis gas and selenium in the acid gas, which were present at less than 1% of the total inlet feed rate to the gasifier.

Air Quality Program Permit No. 54-399-034, issued by the Pennsylvania Department of Environmental Protection for the proposed facilities, establishes maximum allowable limits for total facility emissions of less than 10 tons for any single hazardous air pollutant (e.g., mercury) and less than 25 tons for any combination of hazardous air pollutants during any consecutive 12-month rolling period. The permitted limits function as a cap to ensure that the proposed facilities would be a minor new source of hazardous air pollutants under the National Emissions Standards for Hazardous Air Pollutants regulations.

The permitted limit for this plant does not reflect the actual expected emissions of hazardous air pollutants. In WMPI's application for Air Quality Program Permit No. 54-399-034, an estimate of 3.7 tons per year was provided for the sum of all hazardous air pollutants. This estimate was based on a worst-case scenario required by the Pennsylvania Department of Environmental Protection for comparison with the Pennsylvania Department of Environmental Protection's corresponding 25-ton limit for the sum of all hazardous air pollutants during any consecutive 12-month rolling period. After more detailed analyses, WMPI has estimated that the actual "sum" of hazardous air pollutant emissions would be about 1.5 tons per year. Consequently, the quantity of any single hazardous air pollutant would likely be less than 1 ton per year, which is considerably less than the permitted limit of 10 tons per year. At this time, the only estimates of the proposed facilities' emissions of individual hazardous air pollutants are 38.6 lb per year of mercury and 2.4 lb per year of arsenic.

Based on the same averaging period (12 months), the permit also specifies a maximum allowable limit of 100 tons for ammonia and 15 tons for sulfuric acid mist, which are not designated as hazardous air pollutants under the National Emissions Standards for Hazardous Air Pollutants regulations.

Polychlorinated dibenzo(p)dioxin and polychlorinated dibenzofuran compounds (that is, dioxins and furans) are not expected to be present in the syngas from gasification systems for two reasons (Orr and Maxwell 2000). First, the high temperatures in the gasification process would effectively destroy any dioxin/furan compounds or precursors in the feed. (Gasification temperatures within the refractory-lined reactor would typically range from 2200 to 3600 °F, with associated pressures ranging from near atmospheric to 1200 psi.). Secondly, the lack of oxygen in the reduced gas environment would preclude the formation of free chlorine from hydrochloric acid, thus limiting the potential for chlorination of any dioxin/furan precursors in the syngas. In addition, the temperature profiles where oxygen is present would not be in the favorable range (660 – 1290 °F), for production of free chlorine from hydrochloric acid.

Combustion of syngas in a gas turbine would not be expected to lead to formation of dioxin/furan compounds because very little of the particulate matter required for post-combustion formation of these chemicals would be present in the clean syngas or in the downstream combustion gases.

Measurements of dioxin and furan compounds in gasification systems reviewed by Orr and Maxwell (2000) confirm these theoretical expectations. Measured concentrations of dioxin/furan compounds in gas streams (i.e., raw syngas, clean syngas, sulfur removal acid gas, and flash gas) from a test gasifier evaluated by the EPA Superfund Innovative Technology Evaluation (SITE) Program were all comparable to the blanks, indicating that these species, if present, were at concentrations less than or equal to the method detection limits. Measurement results from a gasification facility in Germany have also shown extremely low levels of dioxin/furan compounds in the clean product syngas.

Visibility

Visibility, or background visual range, is defined as the maximum distance a large, black object can be observed on the horizon. The scenic quality of natural landscapes and their color, contrast, and texture, are improved by good visibility. Visibility, as a measure of clarity of the atmosphere, has been established as an important air-quality-related value of national parks and wilderness areas that are designated as PSD Class I areas. Because concentrations of pollutants from the proposed facilities would be negligible at the nearest PSD Class I area, about 130 miles to the southeast (Section 3.2.2), no degradation in visibility would be perceptible.

Acidic Deposition

Acid rain, the popular name for acidic deposition, occurs when SO₂ and NO_x are chemically transformed and transported in the atmosphere and deposited on the earth's surface in the form of wet (rain, snow, fog) or dry (particle, gas) deposition. SO₂ and NO_x are readily oxidized in the atmosphere to form sulfates and nitrates. Subsequently, the sulfates and nitrates may form sulfuric acid and nitric acid when combined with water, unless neutralized by other chemicals present. Acidic deposition contributes to the acidification of lakes and damage to ecological resources. SO₂ and NO_x can be transported by the wind for hundreds of miles from one region to another. Therefore, air over any given area will contain some residual emissions from distant areas and infusions received from nearby areas. This continuing depletion and replenishment of emissions along the path of an air mass makes it extremely difficult to determine relationships between specific sources of emissions and acidic deposition at any particular location.

As a comparison to evaluate acidic deposition, stack SO_2 emissions from the proposed facilities would be about 29 tons per year, which would be about 0.4% of Schuylkill County's SO_2 emissions inventory of 8,046 tons per year in 1999. Stack emissions of NO_x from the proposed facilities would be about 70 tons per year, which would be less than 1% of the county's NO_x emissions inventory of

8,335 tons per year in 1999. Because these emissions are less than 1% of existing county emissions, no perceptible changes in acidic deposition would be expected.

Global Climate Change

A worldwide environmental issue is the possibility of changes in the global climate (e.g., global warming) as a consequence of increasing atmospheric concentrations of "greenhouse" gases.

International scientific consensus has indicated that the earth's climate is changing and that human activity is a factor (IPCC 2001, 2007). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface and be converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is "trapped" near the earth's surface.

Greenhouse gases include water vapor, CO₂, methane, nitrous oxide, O₃, and several chlorofluorocarbons. While greenhouse gases constitute a small percentage of the earth's atmosphere, their collective effect is to keep the temperature of the earth's surface about 60°F warmer, on average, than it would be if no atmosphere existed. Water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas. The second-most abundant greenhouse gas is CO₂. It has been estimated that CO₂ concentrations in the atmosphere increased by about 35% (from about 280 ppm to 379 ppm) from pre-industrial times to 2005 (IPCC 2007) and by 19% from 1959 to 2003 (Keeling and Whorf 2005). Fossil fuel burning is the primary contributor to increasing concentrations of CO₂ (IPCC 2001, 2007). The increasing CO₂ concentrations likely have contributed to a corresponding increase in temperature in the lower atmosphere. The globally averaged temperature in the lower atmosphere has increased by about 1 to 1.7 °F since the second half of the 19th century (IPCC 2007). Because CO₂ is relatively stable in the atmosphere and essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of CO₂ emissions does not depend on where the emissions occur.

Carbon dioxide emissions to the atmosphere resulting from the operation of the proposed facilities would add about 2,282,000 tons per year to global CO_2 emissions, thus adding to global emissions of CO_2 resulting from fossil fuel combustion, which are estimated to have been 29,000,000,000 tons during the period 2000 to 2005 (IPCC 2007). The total emissions from WMPI would include CO_2 emitted directly to the atmosphere by (1) facility operations (832,000 tons per year), and (2) the concentrated CO_2 stream separated in the gas cleanup system (1,450,000 tons per year; Radizwon 2006), which would be emitted at the site (released through the thermal oxidizer stack). Section 5.1.4 discusses the possible feasibility of CO_2 sequestration during the 50-year life of the proposed facilities. Although not proposed by the applicant, during the 50-year duration of commercial operation, it may become feasible to reduce the project's contribution to global climate change by sequestering some of the CO_2 captured in the process underground.

Scoping Concerns

During the scoping process, local residents expressed concern about the potential for odorous emissions (Section 1.5). The potential for odor would most likely result from emissions of hydrogen sulfide (H₂S). For the proposed facilities, however, nearly complete H₂S removal from the shifted synthesis gas, occurring in the acid gas removal plant using a Rectisol unit, would be required by the downstream F-T synthesis process. Remaining concentrations would be as low as 1 to 5 ppm. The captured H₂S would be converted to marketable elemental sulfur in a Claus sulfur recovery unit, a process which should remove approximately 99.99% of the sulfur from the recovered acid gas stream. Further, the gas streams exiting the Rectisol, Claus, and SCOT units would be sent to a thermal oxidizer to oxidize any trace contaminants prior to being released through a stack to the atmosphere. Because of the high sulfur removal rates in these units and the oxidation of gases vented from them, H₂S odors should not be perceptible at and beyond the project boundaries.

As with state-of-the-art integrated gasification combined-cycle facilities, odors from the proposed facilities should not be perceptible due to the similarity in the technologies, including synthesis gas cleanup equipment. In contrast, a slightly different technological process removes about 75% of the sulfur from the gas stream at Sasol's existing coal-to-oil facilities in Secunda, South Africa. The Secunda facilities, built beginning in 1976, have averaged about 3 odor complaints per month over the last year, primarily for H₂S odors. The rate of complaints is higher at Sasol's coal-to-oil facilities in Sasolburg, South Africa, which have been operating since 1955, because the process removes no sulfur.

Air Quality Program Permit No. 54-399-034, issued by the Pennsylvania Department of Environmental Protection for the proposed facilities, states that the proposed facilities may not emit into the atmosphere any malodorous air contaminants from any source in such a manner that the malodors are detectable outside the property.

During the scoping process, local residents also expressed concern about the possibility of emissions from the proposed facilities creating safety issues, such as fog affecting Interstate 81 (Section 1.5). The primary source of any fog generated by the proposed facilities would be the new bank of 12 mechanical-draft cooling towers. About 1,757 gpm of water would evaporate from the cooling towers (Table 2.1.2), which could condense in the atmosphere to form fog under certain meteorological conditions. Interstate 81 is aligned in a west-southwest to east-northeast orientation in a valley about 1 mile to the south of the proposed site on Broad Mountain. Under most meteorological conditions, the atmosphere would be unsaturated and would provide enough mixing so that the water vapor from the cooling towers would not condense. However, during meteorological conditions when the atmosphere is nearly saturated, winds are light, and mixing is very low (i.e., during some early morning hours), condensation is possible, which would appear in the form of a cooling tower plume and/or fog. The fog would probably not affect Interstate 81 due to the distance from the proposed site. No fog resulting from existing Gilberton Power Plant operations has been

observed on Interstate 81. However, upon initial operation of the proposed facilities, conditions at the interstate would be monitored.

Finally, a concern was expressed regarding airborne emissions resulting from vehicles traveling over red anti-skid material applied to roads (Section 1.5). This material is bottom ash from the existing Gilberton Power Plant, which is applied to alleviate treacherous road conditions during the winter. More vehicles would use the roads during construction and operation of the proposed facilities (Section 4.1.7.8) and would contribute to the breakup of the bottom ash from the existing plant. However, the increases in airborne emissions of this material are not strictly related to increased traffic volume, but rather to the occurrence of treacherous road conditions that call for the application of anti-skid material. The bottom ash from the proposed facilities would be in the form of a glass-like slag, which would not be suitable for use as an anti-skid material and therefore would not be applied to the roads. The proposed project is not expected to affect either the amount and frequency of bottom ash applications to local roads, or the public health or aesthetic effects arising from the applications.

4.1.3 Geology and Soils

4.1.3.1 Mineral Resources

The proposed facilities would increase the removal and utilization of the anthracite culm deposited on the landscape of the project area. The facilities' estimated use of 4,711 tons (dry) of beneficiated culm per day (about 1.7 million tons per year) equates to 2.7 times the culm consumption of the existing Gilberton Power Plant. The proposed facilities would increase total *anthracite* culm utilization by 20 to 140% over levels *reported* during the period from 1993 to 2002, when *reported* anthracite culm utilization in the state ranged from 1.2 to 8.4 million tons per year (Figure 3.3.1). *Anthracite culm availability is more than sufficient for the demonstration period. The culm reserves controlled by WMPI (Section 3.3.3) are estimated to be sufficient to supply the proposed facilities for about 15 years, or to supply both the proposed facilities and the Gilberton Power Plant for about 11 years.*

4.1.3.2 Soils

The proposed facilities would not affect any soil types classified as prime farmland or Pennsylvania farmland of statewide importance. The facilities' use of culm from mine waste dumps in the Mahanoy Creek valley and surrounding region, together with the possible use of project byproduct materials in reclaiming abandoned surface mines and spoil areas, would accelerate the ongoing process of restoring soil productivity in the region.

4.1.3.3 Geologic Hazards

Construction and operation of the proposed facilities could increase the likelihood of ground surface subsidence due to collapse of abandoned underground mine workings, but the potential for such an impact would be small. The facilities' use of water from the Gilberton mine pool would lower the average water level in the mine pool, and thus could reduce stability of the abandoned mine workings below Gilberton (Section 3.3.5.1). However, this would not be expected to increase the likelihood of collapse. Water levels would remain within their current range (Section 3.4.3), and the Pennsylvania *Department of Environmental Protection* has not observed any mine roof collapses or other subsidence from several decades of pumping from the mine pools at Gilberton and other locations in the region (Section 3.3.5.1). The SRBC authorization allowing WMPI to withdraw mine pool water for the proposed project (SRBC 2005) includes conditions intended to ensure that the mine pool water level would not drop below its current elevation range. If a potential were identified for the water elevation to drop below its current range, WMPI would need to seek an alternative water source or take other measures to limit effects on the mine pool water level, as discussed in Section 4.1.4.1. In this circumstance, a delay in implementing actions intended to limit effects on the mine pool possibly could result in excessive drawdown and an increased potential for subsidence below Gilberton. If a sudden collapse or additional gradual subsidence were to occur below Gilberton as a result of the proposed project, impacts would be similar to the historical impacts of subsidence described in Section 3.3.5.1.

Because the proposed main plant would be built over rock units that do not contain coal, the plant would not be affected by subsidence from mining activities. Subsidence could, however, affect product transfer lines and related facilities in the valley of Mahanoy Creek. Abrupt subsidence could rupture product transfer lines and release liquid-fuel product into the environment. Environmental consequences of such an event would be similar to those from collision and rupture of a gasoline truck, potentially including fire, explosion, and release of a toxic material into surface waters and soils. *Health and safety consequences of potential accidents are discussed in Section 4.1.9.1*. Gradual subsidence also could damage product lines and cause leakage, with similar but smaller impacts. The possibility of abrupt subsidence has decreased over time following the closure of underground mines, and will continue to decrease in the future. The potential risks of product line leakage due to gradual subsidence would be reduced by inspecting product lines regularly and repairing any problems.

Although unlikely (as discussed in Section 3.3.5.2), seismic activity also has the potential to cause accidental rupture of product lines and containment systems associated with the proposed facilities, with potential impacts similar to those from abrupt subsidence.

By removing culm waste from the landscape to recover its energy value, the proposed facilities would help to reduce the hazards associated with culm waste, including the potential for culm bank fires. The proposed facilities would not be expected to change either the likelihood of fires or the feasibility and effectiveness of fire control in abandoned underground mines.

4.1.4 Water Resources

4.1.4.1 Surface Water and Mine Pool

Construction

No change in the existing utilization or consumption of surface water or mine pool water would occur during construction of the proposed facilities. No dredge or fill material would be deposited in surface streams.

Water quality could be affected by stormwater runoff from construction sites. However, an Erosion and Sediment Control Plan would be developed and implemented for the project, in accordance with NPDES discharge permit PAR-105804R issued by the Schuylkill Conservation District. Standard engineering practices such as silt fencing, straw bales, revegetation of graded areas, and stormwater detention basins would be implemented to control runoff, erosion, and sedimentation. If runoff from the site drained to old strip mining pits on the north or south slopes of Broad Mountain, any *contained* sediments would settle out in the pits *or be filtered by soil and rock as the water* seep*ed* to the underlying mine pool. If runoff were directed toward tributaries of Mill Creek, it would be routed through detention basins in which sediments would settle out before the water would be released to a stream. Impacts attributable to construction-related runoff would be minimal.

Accidental spills of construction materials such as solvents, paint, caulk, oil, and grease that could contain hazardous substances would be cleaned up in a timely manner and in accordance with a Spill Prevention, Control, and Countermeasure (SPCC) Plan and best management practices, thus minimizing the potential for overland flow into streams.

Operation

Water Quantity. Operation of the proposed facilities would reduce the water volume in the Gilberton mine pool and the volume of water needed to be pumped from the mine pool and discharged to Mahanoy Creek in order to prevent flooding. These changes would result in reduced stream flow in the creek. During normal operation, the proposed facilities would require an estimated flow of 3,779 gpm from the mine pool, including an estimated flow of 2,744 gpm for cooling water and 1,035 gpm for processing in the main plant (Table 2.1.2 and Figure 2.1.6). In addition, about 1,667 gpm would be withdrawn for use in culm beneficiation, which includes operation of the existing beneficiation plant (Table 2.1.2 and Figure 2.1.6). About 2,314 gpm would be consumed in processing² or lost to evaporation. About 1,940 gpm (including an estimated average flow of 93 gpm of stormwater collected from the main plant area) would be discharged from the proposed facilities to the tailings pond in the Mahanoy Creek valley as a blend of treated wastewater and uncontaminated water (Table 2.1.2), and about 1,180 gpm would be discharged to the tailings pond as wastewater

² This quantity includes an estimated 101 gpm that would be consumed in the existing Gilberton Power Plant. Because this is an existing water use, it is not considered in the subsequent assessment of the net effect of the proposed facilities.

from culm beneficiation. The effluents discharged to the tailings pond (an average total of about 3,120 gpm) are expected to seep downward into the Boston Run mine pool.

The net effect on water flux in the mine pool system would be a reduction of about 2,225 gpm or 994 million gal per year (assuming operation of the facilities at an 85% capacity factor). This is equal to about 40% of the water volume currently pumped to Mahanoy Creek from the Gilberton mine pool to control the mine pool elevation. This would allow the Commonwealth of Pennsylvania to reduce its pumping of the mine pool by approximately 40%. The discharge of untreated mine pool water to Mahanoy Creek would be reduced by the same percentage. Water elevations in the Gilberton mine pool would continue to fluctuate within their current range (Section 3.4.3), but the mine pool water elevation would be lower on average than under current conditions.

SRBC (2005) has raised questions about the capacity of the Gilberton mine pool to supply sufficient water to meet the needs of the proposed facility and its existing water users on a sustainable basis. This concern is based primarily on an absence of evidence for free flow of water between the Boston Run mine pool (to which project effluents would be discharged) and the Gilberton mine pool (from which water would be withdrawn). If these two mine pools are not well interconnected, project effluents might be slow to replenish the Gilberton mine pool during a drought, causing the water elevation in the Gilberton mine pool to drop below the current range of fluctuation. The SRBC authorization allowing WMPI to withdraw mine pool water for the proposed project includes conditions intended to ensure that the mine pool water level would not drop below 1,084 ft amsl. If the pumping water level in the Gilberton shaft were to drop below 1,087 ft amsl, WMPI would be required to submit an evaluation of the potential for additional drawdown and apply for additional withdrawal locations if the evaluation indicates a potential for the water elevation to decline below 1,084 ft amsl (SRBC 2005). Alternatively, it might be possible to reduce drawdowns by reinfiltrating process effluents at a site directly over the Gilberton or Lawrence mine pools. Possible alternative water sources include other mine pools or a public water supply system. With any alternative supply source, conflicts with other water users are possible, but because water supply in Schuylkill County appears to exceed current demand (Section 3.4.4), it should be possible to avoid such conflicts. Any alternative source would require SRBC approval and construction of a new water supply line. Similarly, development of a new seepage pond for reinfiltration of effluents could require Pennsylvania Department of Environmental Protection approval, as well as construction of both a new pond and an additional effluent discharge line. If delays in these steps or other factors were to delay establishment of a new water supply, it is possible that excessive drawdowns could occur (Section 4.1.3.3).

Reductions in pumping from the mine pool for discharge to Mahanoy Creek would reduce the frequency and duration of high-flow episodes in the stream that are caused by discharges from the mine pool pump. Also, there would be a reduction in the average flow of water in the stream. Because the stream is not a source of water supply (Section 3.4.4) due to poor water quality, the potential impacts of changes in flow are limited to impacts on in-stream conditions. Averaged over a year, streamflow in Mahanoy Creek would be reduced by 4.2 ft³/s, which is 35% of the average flow

at Girardville (Section 3.4.1). *There would be no reduction in streamflow during low-flow periods*, *when the* creek's minimum flows would continue to be maintained by continuous discharges from mine openings in upstream portions of the watershed. Peak (flood) flows also are unlikely to be affected because the state's pumps normally would not be operated during flood events. Because the only known uses of Mahanoy Creek are in-stream uses, such as receipt of treated sewage *and habitat for aquatic organisms*, no impacts on water availability would be expected from reductions in pumping.

Water Quality. Project operation would affect water quality in both Mahanoy Creek and the mine pool system, leading to both positive and negative impacts. Facility effluents discharged to the mine pool system would return to the mine pool system with near-neutral pH and less acidity and lower dissolved metal concentrations than were contained in the water withdrawn from the mine pool system. This would result in improvements to the quality of the mine pool water with respect to these contaminants. Treatment and use of mine pool water, generation of liquid process wastes, and treatment of plant wastewater would also contribute to modifying the quality of the water discharged back into the mine pool system. In addition, reduced operation of the pump maintained by the Pennsylvania Department of Environmental Protection would reduce the amount of poorquality water entering Mahanoy Creek from the mine pool. However, effluents from the proposed facility could introduce new contaminants to the mine pool system, and subsequently to Mahanoy Creek.

Two principal project-related wastewater streams would be discharged to the tailings pond: (1) wastewater from culm beneficiation and (2) wastewater from the proposed production facilities.

DOE has no data on the chemical characteristics of wastewater effluent that is currently discharged to the tailings pond from the anthracite culm beneficiation facility adjacent to the project site. However, it is reasonable to assume that the concentrations of dissolved solids (such as iron, aluminum, and sulfate) in beneficiation effluents from this facility and from the new or expanded facility would be similar to or slightly higher than the concentrations found in the mine pool water used in the beneficiation process (Table 3.4.2). Suspended solids such as coal fines and rock particles would also be present in this effluent.

The second project-related wastewater stream, effluent from the principal facilities, would be a blend of several different wastewater streams identified in Section 2.1.6.2. The contaminant concentrations included in the wastewater effluent limits that WMPI has proposed to Pennsylvania Department of Environmental Protection for purposes of its Water Quality Management Part II permit application (Chandran 2005), listed in Table 2.1.4, are higher than reported for similar facilities (SAIC 2002). Thus, WMPI-proposed limits provide a conservative basis for assessing potential impacts of effluent discharges. For substances not listed in Table 2.1.4 (such as total dissolved solids and iron), approximate concentrations or total loadings were estimated based on data compiled by SAIC (2002), information about facility production and water treatment

processes, and WMPI's estimates (WMPI 2005c) of the characteristics of some individual wastewater streams prior to treatment.

Mine pool water to be used for cooling water would be treated to reduce its iron concentration to less than 0.5 mg/L using aeration, followed by lime treatment. The water would then be sent to a clarifier and finally filtered. These processes should be effective in removing manganese and aluminum, as well as iron. These metals would be transferred to water treatment sludge, which would be handled as a solid waste (Section 4.1.8.2), and thus would not be present in the wastewater discharged to the mine pool system. Lime treatment and other neutralization processes would balance the water's acidity with an equivalent amount of alkalinity. Assuming 99% removal of iron and manganese from the 2,750 gpm of mine pool water obtained for cooling, 1,400 lb of iron and 300 lb of manganese would be removed daily.

Mine pool water to be supplied to the main plant, including potable water supply for facility workers, would be treated by reverse osmosis to remove most dissolved substances. Water to be used in boilers and other processes would undergo an additional demineralization step to remove almost all dissolved substances. Reverse osmosis and demineralization would produce concentrated wastewater streams containing dissolved minerals removed from the mine pool water. Because WMPI proposes to discharge these concentrated wastewaters without any treatment other than physical settling, sulfates and other soluble constituents removed from the mine pool water would pass untreated into the wastewater discharge.

Following the various treatment steps and processing activities in the facilities (which would concentrate natural minerals in the water), facility effluents could have total dissolved solids levels as high as about 2,000 mg/L, including sulfate concentrations estimated at about 1,400 mg/L. Concentrations of substances such as calcium, magnesium, and sodium would be higher than in the mine pool water, but concentrations of iron and other dissolved metals would be much lower. The average iron concentration could be about 4 mg/L.

Discharge of the facility effluents to the mine pool system by seepage from the tailings pond would reduce concentrations of acidity and dissolved metals in the mine pool system. Consequently, water pumped from the Gilberton mine pool to Mahanoy Creek would also have lower concentrations of mine-related contaminants, contributing toward meeting the Pennsylvania Department of Environmental Protection's total maximum daily load targets for these contaminants (Section 3.4.1). Potential reductions in total maximum daily load are discussed quantitatively in the following subsection on "Alternative Water Management Approaches." However, these potential water quality improvements to Mahanoy Creek might not be fully realized due to (1) mixing with untreated effluent from coal beneficiation and (2) the chemical reactions occurring with minerals in the tailings pond sediment, soil, coal, and rock as the water passes from the tailings pond to the mine pool and through the mine pool system before discharge to Mahanoy Creek. While metals are relatively insoluble in water at neutral or alkaline pH, reactions with pyrite and other minerals in the soil and rock would likely deplete the alkalinity in the water, increasing the water's acidity, allowing some dissolution of metals to continue. Such water quality

changes might be similar to those currently observed near the B-D Mining coal refuse processing and coal ash placement site in Mahanoy Valley near Gilberton. Sampling of monitoring wells in this area and in the mine pool indicates substantially reduced acidity, some reduction in iron and manganese, but little improvement in other water quality parameters (Hornberger et al. 2004).

Additionally, the facilities' wastewater treatment system would be designed to treat organic residues (Section 2.1.6.2), but WMPI's proposal for maximum contaminant concentrations for effluent discharges indicates that effluents from the facilities could contain large residual amounts of organic compounds and other process residues (Table 2.1.4). Toxic and carcinogenic substances, including *phenols*, cyanides, and polycyclic aromatic hydrocarbons (PAHs), such as pyrene, might be present in low concentrations (Table 2.1.4; SAIC 2002). Any wastewater constituents that are not successfully treated in the wastewater treatment facility are unlikely to degrade naturally within the mine pool system. The wastewater constituents are conservatively assumed to pass into the creek in the water pumped from the mine pool, although concentrations could be reduced to an unknown extent by dilution within the mine pool. Also, because there would be only minimal treatment of cooling tower blowdown and other non-oily wastewaters (Section 4.1.8.2), biocides, scale inhibitors, and other contaminants in these waste streams are also assumed to pass into the mine pool. Subsequent pumping of mine pool water into Mahanoy Creek would deplete dissolved oxygen in the creek (due to the high levels of biochemical and chemical oxygen demand in the discharged water, as described in Table 2.1.4), thus further degrading the creek as potential habitat for aquatic organisms. Effluents to Mahanoy Creek would also substantially exceed Pennsylvania's statewide ambient water quality standards for chlorine and ammonia in waters whose designated use is warm-water fish habitat (25 Pa. Code Chapter 93) and US EPA's recommended water quality criteria for zinc and sulfide in freshwater aquatic habitats

(http://epa.gov/waterscience/criteria/wqcriteria.html, accessed June 16, 2006). Unless extensive mixing occurs within the mine pool, which is unlikely, discharge of mine pool water could cause Mahanoy Creek to exceed these ambient criteria. (Potential impacts to the creek water quality in the absence of additional dilution are discussed in the following subsection on "Alternative Water Management Approaches.") Any adverse effects on Mahanoy Creek from small concentrations of toxic substances such as phenols, cyanides, and PAHs potentially present in the facility effluent would probably be undetectable because of the overriding impacts of acid mine drainage and dissolved oxygen depletion, but the presence of these substances could add to the challenges involved in restoring stream functions. Human exposure to these substances would be unlikely to occur in the site vicinity because people do not use the stream water. Potential downstream impacts of these toxins would be reduced by natural degradation (for example, of cyanides) and dilution in the stream. Concentrations of sulfate, calcium, magnesium, and other natural constituents in the stream could increase, but these increases would not affect attainment of water quality criteria. No water quality criteria exist for sulfate in waters designated for use as aquatic habitat. If the quality of discharged water discharged to Mahanoy Creek is determined to be unacceptable, additional

treatment steps could be incorporated into the wastewater treatment system to reduce adverse impacts to stream water quality.

Alternative Water Management Approaches. As part of its exploration of the potential impacts of the proposal, DOE has considered the potential impacts of two alternative water management approaches: (1) discharge of facility wastewater effluents directly into Mahanoy Creek, rather than into the tailings pond; and (2) recycling of storm water and some other facility effluents for in-plant uses, thus reducing requirements from the mine pool system. These alternative approaches were considered based on comments received on the draft EIS. In addition, an April 20, 2006, letter from Pennsylvania Department of Environmental Protection staff to WMPI's consultant (Hannigan 2006) identified direct discharge to the stream as an option for discharge of effluents from the proposed facilities. The letter also mentioned the possibility of injecting effluents directly into the mine pool using an injection well; DOE has not analyzed the impacts of that approach in detail because it offers no apparent advantages, but would add additional costs and potential impacts, such as subsurface erosion within the mine pool.

Discharge of facility wastewater effluent directly to Mahanoy Creek would require construction of a longer water discharge line from the proposed facilities. For purposes of assessment, the discharge location in the creek is assumed to be near the location where the Pennsylvania Department of Environmental Protection pump discharges mine pool water to the creek. This discharge location was suggested by Hannigan (2006). Because a large-volume water discharge already enters the creek at this site, the additional discharge would be less likely to adversely affect the physical stability of the stream channel at this location than if it the water were discharged at an upstream location closer to the tailings pond. It is further assumed that land disturbance for construction of the discharge line would be minimized by locating it adjacent to the water intake line for the proposed facilities on the north slope of Broad Mountain and adjacent to the railroad in the Mahanoy Creek valley. Discharges to the creek are assumed to include all stormwater runoff and effluents from production facilities and cooling towers that are currently proposed for discharge to the tailings pond (a total of 1,940 gpm on average), but not coal beneficiation plant wastewater, which would continue to be discharged to the tailings pond. Because less water would be intentionally discharged to the mine pool system, it should be possible for the Pennsylvania Department of Environmental Protection to reduce its pumping and discharge of water from the Gilberton mine pool. The calculated potential reduction in mine-pool pumping requirements resulting from the combination of increased water consumption and discharge directly to the creek is 87% of the current average pumping rate of 4,800 gpm. The actual reduction in pumping requirements could be somewhat smaller because some of the discharged water would seep from the creek bed into the underlying mine pool. However, there would be a substantially larger potential for the pumping water level in the Gilberton mine pool to drop below its current elevation range, potentially resulting in a greater likelihood of underground mine subsidence below Gilberton (Section 4.1.3.3). Streamflow would be higher on average and less variable than under current conditions or under the proposed action.

Dissolved oxygen in Mahanoy Creek would be severely depleted as a result of the projected high levels of biochemical and chemical oxygen demand in the facility effluent (Table 2.1.4). Because the stream would provide minimal dilution of the high contaminant concentrations in proposed facility effluents (the effluent discharge of 4.3 ft³/sec would be larger than the measured streamflow of 2.8 ft³/sec), in-stream concentrations of several contaminants in the effluent would exceed levels appropriate for aquatic life. For example, even assuming complete instantaneous mixing in the stream, the in-stream concentrations of ammonia nitrogen (up to 28 mg/L) and chlorine (up to 0.12 mg/L) would substantially exceed the Pennsylvania statewide ambient water quality standards for warm-water fish habitat (the ammonia nitrogen limit, which must be determined by a complex calculation from stream temperature and pH, generally is well below 5 mg/L, while the chlorine limit is 0.011 mg/L), and the in-stream concentration of zinc (0.92 mg/L) would exceed the EPA recommended water-quality criterion for freshwater aquatic life (0.12 mg/L). Mixing with air and other natural in-stream processes would remove ammonia, chlorine, and oxygen-depleting contaminants from creek water during stream flow, so the adverse effects of oxygen depletion and elevated ammonia levels would extend for a limited distance downstream from the discharge point. Similarly, zinc concentrations would be diminished by dilution and instream chemical processes. Because limited data are available on characteristics of the effluent and the creek, DOE has not calculated the flow distance within which adverse impacts could be attenuated.

Wastewater data from operating coal gasification facilities (SAIC 2002) suggest that it may be possible to achieve effluent concentrations well below the values in Table 2.1.4. For example, data from other facilities suggest levels of chemical oxygen demand and zinc could be about 5 times smaller than the values in the table, while levels of ammonia could be about 2 to 3 times smaller than the values presented in the table. Such reductions in pollutant concentrations could reduce adverse impacts to stream water quality. However, due to the low assimilative capacity of Mahanoy Creek in the vicinity of the project and discharge sites, that portion of the stream would have diminished suitability for aquatic life.

Loadings to Mahanoy Creek of iron, manganese, acidity, and aluminum would be reduced more than with effluent discharge to the tailings pond because (1) there would be less pumping from the Gilberton mine pool to the creek and (2) project effluents would not circulate through the mine pool system before being discharged to the stream. Due to the estimated removal of 300 lb/day of manganese in water treatment, manganese loading to Mahanoy Creek would be reduced to below the state's proposed total maximum daily load (water quality) target for manganese in the stream reach, which requires removal of 135 lb/day (Section 3.4.1). The estimated removal of 1,400 lb/day of iron also would be more than sufficient to meet the total maximum daily load target, which requires removal of 309 lb/day. Due to the large variability in reported concentrations of acidity and aluminum in the mine pool water (Table 3.4.2), it is not possible to quantify the effect

of discharge on total maximum daily load targets for these substances, but the removal of these mine pool contaminants from water would also contribute to meeting contaminant-specific water quality goals in the stream. However, because of the depletion of dissolved oxygen and excessive concentrations of other pollutants deleterious to aquatic life, in the vicinity of the discharge the potential for Mahanoy Creek to provide suitable habitat for aquatic life would not improve in spite of the reduced variability of stream flow and reduced loadings of manganese, acidity, aluminum, and iron. If the quality of discharged water is determined to be unacceptable, additional treatment steps could be incorporated into the wastewater treatment system to reduce adverse impacts to stream water quality.

Recycling of storm water and other facility effluents for in-plant uses would decrease the volumes of withdrawals from the mine pool and discharges to the tailings pond. To estimate the magnitude of the potential impacts from effluent recycling, DOE assumed that only non-process wastewaters with total dissolved solids concentrations comparable to or less than mine pool water would be suitable for recycling. These wastewaters include (Table 2.1.2 and WMPI 2005c) stormwater from uncontaminated areas (flow rate of 49 gpm, averaged over a year), purge water from treating mine pool water for cooling-tower use (110 gpm), recovery condensate purge (110 gpm), and boiler blowdown (43 gpm), with a combined average flow of about 310 gpm. By directing these wastewaters to the reverse osmosis and demineralization units (following removal of suspended solids by coagulation and settling), WMPI could reduce the mine-pool water requirement for process supply (1,035 gpm under the WMPI proposal) by about 30% and could reduce total mine-pool pumping requirements (5,446 gpm under the WMPI proposal) by about 6%. Discharges to the tailings pond would be reduced by about 10% compared with the WMPI proposal. Because the consumptive use of water in the facilities would not be affected by recycling, there would be no effect on the amount of water the state would need to pump from the Gilberton mine pool. However, because there would be less pumping from the mine pool to supply the proposed facilities, there would be a slightly smaller chance for the water elevation in the Gilberton mine pool to drop below its current range of fluctuation.

Effects of effluent recycling on the project's impacts on water quality in the mine pool and creek are estimated to be small. Mine-pool contaminants discharged to the tailings pond would be slightly lower than under WMPI's proposal, but overall contaminant concentrations in effluents to the mine pool would be somewhat higher due to the smaller volume of water available for dilution. Other potential impacts of effluent recycling would include lower energy utilization for pumping water and reduced utilization of water filtration media. Minor changes in facility configuration would be needed to facilitate effluent recycling.

4.1.4.2 Groundwater

Construction and operation of the proposed facilities would not change groundwater use on Broad Mountain. Water for the facilities would be drawn from the mine pool, not from sources on Broad Mountain. *Additionally, withdrawals from the valley mine pool would not reduce groundwater*

availability on Broad Mountain because groundwater moves from the uplands toward the valleys; aquifers on the mountain are upstream from the mine pool. As noted in Section 3.4.2, the large-scale dewatering of valley aquifers that occurred during operation of valley mines in the proposed project area was not reported to have affected groundwater levels in uplands. SRBC (2005) also concluded that mine pool withdrawals for the proposed facilities would not affect existing wells. However, the facilities' development could affect groundwater availability by increasing the area of impervious surface, thus reducing groundwater recharge to the aquifers on Broad Mountain. Water that previously would infiltrate the soil to enter the groundwater under Broad Mountain would instead become stormwater runoff and would be discharged to streams or strip mining pits. Thus, this water would not be available to recharge the aquifers on Broad Mountain.

Assuming that the project would prevent groundwater recharge of 15 in. per year (Section 3.4) over 50 acres of the 75-acre site, the reduction in recharge would be 2.7 million ft³ per year (39 gpm or almost 56,000 gal per day). Because the onsite septic system for disposal of sanitary wastewater from the proposed facilities would replace some of this recharge by discharging an estimated 4 gpm into the aquifer, the net loss in recharge would be 35 gpm or 50,000 gal per day. For comparison, this is about 60% of the combined volume of groundwater supplied by the wells serving the Gilberton Power Plant and the Morea water system (Section 3.4.4). This reduced recharge should not adversely affect users of the Morea water system. Recharge from areas closer to the Morea well (i.e., within a 1,000-ft radius) is estimated to be almost 4 million ft³ per year (56 gpm or 80,000 gal per day), which is more than enough to meet the needs of the Morea water system (20,500 gal per day).

The wells serving the Gilberton Power Plant are closer to the proposed main plant site than the Morea well is to the main plant site, and thus would be more likely to experience any impacts from reduced recharge. Because other wells in the area are farther from the proposed facilities than the Morea well is from the proposed facilities, they also should not be affected by reduced recharge.

Most potential impacts to groundwater quality on Broad Mountain would be avoided by implementing standard engineering practices, including collection of potentially contaminated runoff and cleaning up accidental spills in a timely manner. The proposed septic system for sanitary wastewater disposal would discharge effluents to the aquifer, but these effluents should not adversely affect groundwater quality. The septic system would be designed and operated in accordance with permitting requirements and would only receive wastewaters like those generated by households. Silty sand soils, such as the soils found on Broad Mountain, are usually effective in filtering and attenuating contaminants in effluents from properly designed and maintained septic systems. Dilution of the relatively small volume of septic effluent by the much larger volume of natural groundwater recharge would minimize the impacts of any contaminants that do reach groundwater.

4.1.5 Floodplains, Flood Hazards, and Wetlands

4.1.5.1 Floodplains and Flood Hazards

The main plant would be located at an elevation well above the Federal Emergency Management Agency's delineated 100- and 500-year floodplains (Section 3.5.1). A new culm beneficiation plant or expansion of the existing facility in the adjacent valley to the north of the main plant area would also lie above the elevation of the 100- and 500-year floodplains. The following project ancillary facilities, however, would cross the 100- and 500-year floodplains of Mahanoy Creek: (1) two product rundown pipelines to *the* railroad siding, (2) an expansion of the coal conveyor from the culm beneficiation plant, and (3) a pipeline for mine pool water. These structures would be placed atop an existing trestle at an elevation above the level of the 100- and 500-year floods (FEMA 1983, 1986). No new construction within the floodplain would be required.

Staff of the Pennsylvania Department of Environmental Protection have identified a concern that the tailings pond, which is anticipated to receive facility effluents, is surrounded by an earthen berm constructed of potentially unstable materials (Hannigan 2006), including coal waste and silt material. Increasing the amount of water discharged to this pond by adding waters related to operation of the proposed facilities could increase the elevation of water within the tailings pond, which would increase the water pressure on the berm and increase the potential for berm failure. If the berm were to fail, the resulting release of water and solids from the pond could cause flooding in the vicinity of the pond (for example, at the beneficiation plant) and downstream (in Gilberton). Some historical failures of mine tailings impoundments have had severe adverse consequences. For example, in February 1972, failure of a coal waste impoundment on the Buffalo Creek in West Virginia resulted in the most destructive flood in West Virginia's history, causing 125 deaths, 1,100 injuries, and extensive property damage. In October 2000 a 72-acre coal tailings impoundment failed in Martin County, Kentucky, releasing approximately 250 million gallons of slurry into local streams and causing significant environmental damage (National Research Council 2002). More recently, in August 2005, the failure of a discharge structure at a fly ash impoundment at a power plant at Martins Creek in eastern Pennsylvania caused 100 million gallons of water containing fly ash to be accidentally released into the Delaware River (PPL Corp. 2007a, 2007b).

The probability and potential consequences of a tailings pond failure at the Gilberton site have not been quantified. However, the Gilberton tailings pond appears to be less susceptible to catastrophic failure than impoundments such as those at Buffalo Creek and Martin County. Unlike the Buffalo Creek impoundment, the Gilberton tailings pond receives surface water runoff from a relatively limited area, so there would be much less potential for a large rainfall event to dramatically increase the water pressure on the pond walls. Unlike the Martin County impoundment, water-filled underground coal workings are not present on the uphill side of the Gilberton tailings pond, making it unlikely that release of water from underground coal workings could increase water pressure on the pond walls. Furthermore, if the pond were to fail, the

relatively low land surface slope in the valley would limit the velocity and distance of travel of the pond contents, thus resulting in less severe consequences than could occur in steeper watersheds.

In addition, the potential for failure of the earthen berm could be reduced, but not eliminated, by discharging facility effluents directly to Mahanoy Creek (bypassing the tailings pond). This would have the effect of reducing the volume of water managed in the pond. The Pennsylvania Department of Environmental Protection (Hannigan 2006) identified direct discharge to the creek as an option that could help address concerns about possible pond instability. Although this potential measure has not been proposed by the industrial participant, it is discussed as an Alternative Water Management Approach in Section 4.1.4.1. The designation of a discharge location would be part of the Pennsylvania Department of Environmental Protection water quality permitting process.

4.1.5.2 Wetlands

Construction and operation of the proposed facilities would have no adverse effects on wetlands because none are present on the project site. The proposed project site was examined for presence of wetlands using the criteria of hydrology, hydric soils, and wetland vegetation, as specified in the 1987 Army Corps of Engineers Delineation Manual (Dilley 2003). No wetlands were found during the survey. A splash zone was found beneath an actively releasing steam valve, but the area did not meet the criteria of a wetland. No surface waters were reported on or in the immediate vicinity of the proposed main project site, nor were any expected due to its ridge-top location (Dilley 2003). Runoff and spills from the site would be controlled by standard construction engineering practices and spill control procedures (Section 4.1.4).

4.1.6 Ecological Resources

4.1.6.1 Terrestrial Ecology

Construction

Approximately 75 acres of deciduous forest would be permanently lost to construct the main plant. An additional 1.5 acres, which would be cleared for ancillary structures, would revegetate to some extent. Loss of this habitat, increased human activity in the main plant area, increased traffic on local roads, and noise would be the most important factors that would affect wildlife species.

The presence of construction crews and increased traffic would cause some wildlife species to avoid areas next to the construction site during the 30-month construction period. Wildlife inhabiting the area rely on native trees, shrubs, and groundcover for food and shelter and would be affected by vegetation clearing. Burrowing and less mobile species such as amphibians, some reptiles, and some small mammals could be adversely affected during vegetation clearing and grading and other site preparation activities. The loss of deciduous forest during construction would displace some small mammals and songbirds from the construction areas, but would not be expected to eliminate any

wildlife species from Broad Mountain because similar habitat is relatively common along, and on both sides of, the ridge. Clearing for support facilities, i.e., product rundown lines, mine pool water source and return lines, and natural gas line, would create additional forest edge and introduce habitat diversity as these areas partially revegetated. This would tend to benefit edge-related wildlife species, while displacing forest-related species from the new habitat.

Construction would temporarily modify the quality of the surrounding habitat in the project area by the creation of noise. Noise levels at a distance of 50 ft typically associated with earthmoving equipment range from 73 to 96 dB(A), and 82 dB(A) for chain saws (FHWA 2005; Revelle and Revelle 1974). Published results from several studies indicate that small mammals and birds might be adversely affected by the maximum noise levels produced by construction equipment (Luz and Smith 1976; Brattstrom and Gondello 1983). White-tailed deer and other skittish larger mammals would not use the areas near the proposed site during construction activities because of noise and the presence of workers. *Because larger and more mobile species would tend to avoid construction areas due to associated noise, no* long-term impacts on the hearing ability of *these* species would be expected from construction-generated noise.

Some unavoidable impacts on wildlife would occur as a result of increased vehicular traffic. Construction traffic along the new access road would increase the potential for roadkills for animals such as turkeys, squirrels, and chipmunks.

Birds of prey passing through, or possibly otherwise using the area, probably would not be adversely affected by the loss of prey base that would be associated with the clearing of the total of 76.5 acres of vegetation, due to the existence of much similar habitat nearby. However, their foraging in areas next to construction sites might be reduced due to increased human activity.

To mitigate impacts of construction to ecological resources, forest clearing would be minimized to the extent practicable by clearing no more land than absolutely necessary for construction. Best management practices (BMPs) for sediment and erosion control, including use of silt fence, straw bale structures, and geotextile materials would be employed where appropriate. Excavated areas surrounding the proposed facilities would be reseeded following construction, and where practicable, some areas would be allowed to revert to forest.

Operation

The impacts on wildlife and vegetation from air emissions due to routine operations should be minor. For the criteria air pollutants SO₂, NO₂, PM-10, and CO, modeled estimates of increases in ground-level concentrations due to project emissions are generally low (Table 4.1.1), and actual degradation of air quality should be less than the amounts predicted (Section 4.1.2.2). Although no estimates of project-related hazardous air pollutants and trace elements are currently available, the cleaning of synthesis gas would result in a high percentage of removal (Section 4.1.2.2). Trace elements and organic compounds would be released at low concentrations and would be diluted further by atmospheric dispersion over a large geographic area, resulting in deposition amounts that should be below levels known to be harmful to wildlife and vegetation or to affect ecosystems

through bio-uptake and biomagnification in the food chain (Will and Suter 1995; Suter and Tsao 1996; Jones, Suter, and Hull 1997; Sample, Opresko, and Suter 1996).

The culm that would be used as feedstock for the proposed facilities would be obtained from culm banks deposited during previous anthracite mining in the region. Pennsylvania law (25 Pa. Code 88.181.243) requires that remined culm banks be graded to minimize erosion and that vegetation be successfully established for at least 5 years. Trees would be planted as part of reclamation and revegetation efforts. Consequently, operation of the proposed facilities would result in reclamation of anthracite mined lands in the adjacent valley and the region. Actively remining previously abandoned surface or deep mines is encouraged by the Pennsylvania Department of Environmental Protection (2004c) as the most efficient way to reclaim abandoned mine lands at no cost to taxpayers. *The* Pennsylvania Department of Environmental Protection could waive a mine permit requirement for coal obtained from refuse material on abandoned mining property if the proposed project meets the respective applicable technical guidance document requirements and respective federal Office of Surface Mining and Pennsylvania Department of Environmental Protection regulations (Section 7.2). Although a reasonable estimate cannot be made of the amount of land that would be reclaimed during the 3-year demonstration period (because of uncertainty in the selection of culm banks to be used and variations in bank dimensions), approximately 1,000 acres would be reclaimed over the *first* half of the 50-year operating life of the proposed facilities. Over the long term, the terrestrial habitat created on reclaimed lands would offset the 76.5 acres of deciduous forest that would be cleared for the proposed facilities.

4.1.6.2 Aquatic Ecology

Impacts to aquatic habitats and fish from construction of the proposed facilities would be minor to negligible. No surface waters are on or in the immediate vicinity of the proposed project site. Best management practices (BMPs) for sediment and erosion control, including use of silt fences, straw bale structures, and geotextile materials would be employed during construction. Accidental spills of construction materials such as solvents, paints, oil, grease, and hazardous substances would be controlled in accordance with an appropriate Spill Prevention, Control, and Countermeasure Plan. Thus, impacts to the closest surface water body, a tailings pond along Mahanoy Creek more than 0.25 mile from the proposed plant site, would be unlikely.

Operational water for the proposed facilities would be withdrawn from the mine pool. Wastewater, including any contaminated runoff from the project site, would be handled using a combination of stormwater retention, wastewater treatment, oil recovery, biological treatment and solids removal, and disposal. Wastewater treatments would include equalization, API (American Petroleum Institute) separator treatment for oil removal and recovery, dissolved air flotation for additional oil removal, and biological treatment. Spills at the project site and ancillary structures such as the product rundown lines would be controlled consistent with a spill control plan. Product rundown lines would be designed to withstand flooding and earth slides. Potential for spill-related liquid effluents to reach surface water bodies would be low.

As discussed in Section 4.1.4.1, use of mine-pool water in the proposed facilities would reduce the amount of water discharged to Mahanoy Creek from the mine pool, thus reducing the frequency and duration of high-flow episodes in the creek, but not reducing streamflow during low-flow periods. Flow stabilization could improve the physical habitat of the creek for fish and other aquatic biota.

Effluents from the proposed facilities would have near-neutral pH and lower concentrations of acidity and dissolved metals than are contained in the mine pool water that currently is discharged to the creek at Gilberton. However, this water would be expected to contain large residual amounts of organic compounds and other process residues.

The effect of returning some of this effluent, via seepage from the tailings pond to the mine pool and subsequent pumping to Mahanoy Creek, on the aquatic ecology of the creek would depend on the chemical interactions and mixing that occur within the mine pool. Mahanoy Creek is substantially altered due to acid mine drainage. Introduction of facility effluent would tend to increase the pH of mine pool water pumped to the stream and reduce availability of metals to stream organisms. However, the introduction of organic and process residues in the treated wastewater would tend to contribute to oxygen depletion and add other contaminants deleterious to aquatic life (Section 4.1.4.1), thus hindering the reestablishment of aquatic biota in stream reaches below the Gilberton pump.

If the alternative water management approach of discharging the treated wastewater directly to Mahanoy Creek, instead of to the tailings pond, were implemented (Section 4.1.4.1), physical habitat quality in the creek would be improved due to reduced flow variability relative to current conditions or discharge to the mine-pool system. Less acidity and other mine-pool contaminants would enter the creek than under current conditions or with discharge to the mine-pool system. Depletion of dissolved oxygen in the creek and excessive concentrations of other contaminants harmful to aquatic life would, however, severely limit the stream's potential to provide suitable habitat for aquatic life (Section 4.1.4.1).

More extensive wastewater treatment at the proposed facilities (for example, by including additional treatment steps in the wastewater treatment system) could reduce or eliminate the potential for adverse impacts to water quality and aquatic biota from oxygen depletion and other process-related contaminants.

Land reclamation following culm bank removal for project feedstock would be expected to reduce acid mine drainage and pollution of streams and rivers in the anthracite coal region (PDEP 2004c). Removal of culm banks followed by grading and vegetation establishment would act to reduce infiltration of rainwater and snowmelt into pyrite-bearing strata, thus reducing acid mine drainage (Klemow 2000; Hawkins 1995).

4.1.6.3 Threatened and Endangered Species

Because the proposed facilities would not be located within an area that provides habitat for any endangered, threatened, candidate, special concern, or rare species of bird, mammal, reptile,

amphibian, fish, aquatic invertebrate, or plant recognized by the state or federal government, except for occasional transient individuals (Section 3.6.3), it is unlikely that any such species would be affected by project construction or operations.

In compliance with Section 7 of the Endangered Species Act of 1973, as amended, DOE requested consultation with the U.S. Fish and Wildlife Service regarding potential impacts of the proposed facilities on threatened and endangered species. The U.S. Fish and Wildlife Service response indicated that, with the exception of occasional transient individuals, no federally-listed or proposed threatened or endangered species are known to occur within the project impact area, and that no biological assessment or further consultation under the Endangered Species Act would be required (Appendix A).

4.1.6.4 Biodiversity

About 75 acres of second-growth deciduous forest typical to the region would be lost due to clearing and construction on the project site. Given the predominance of this forest type in the region it is unlikely that unique genetic information, or rare species or ecosystem components, would be lost. Thus, discernable impacts to biodiversity would not be expected.

4.1.7 Social and Economic Resources

The social and economic impacts of the proposed project would be most noticeable during the 30-month construction period, when an average of 516 workers would be on the site. These impacts would peak during a 6-month period when 1,000 workers would be on the site. The project would also have short-term impacts from employment of 250 workers during the 36-month demonstration period immediately following construction, and long-term impacts from employment of 150 workers for operations after completion of the demonstration (Sullivan 1997). This assessment focuses primarily on the social and economic impacts of project construction and long-term operations because construction would have the largest impacts and operations would have the longest-lasting impacts. The assessment focuses less on the social and economic impacts of the 36-month demonstration period because they would be smaller than those of the construction period and of shorter duration than those of the operations period.

In addition to the direct jobs that would be created by project construction and operations, a number of indirect and induced jobs would be created. Indirect jobs are those created by businesses that provide goods and services essential to the construction and operation of a project. Induced jobs are those created "by the spending of the wages and salaries of the direct and indirect employees on items such as food, housing, transportation, and medical services" (NEPaA 2004b).

Using calculations based on the Northeastern Pennsylvania Alliance *Economic Impact Model*, the average number of direct jobs during project construction (516) could create as many as 181 indirect jobs and 175 induced jobs, for a total of 872 jobs (NEPaA 2004c). The peak number of direct jobs during construction (1,000) could create as many as 351 indirect jobs and 338 induced jobs, for a total of 1,689 jobs (NEPaA 2004c). *It is important to note that not all of these jobs would be filled by*

current residents of Schuylkill County. However, it is expected that most of the jobs not filled by county residents would be filled by current residents of the east central Pennsylvania region.

Similarly, during long-term operation of the proposed facilities, the 150 direct jobs could create as many as 115 indirect jobs and 173 induced jobs (NEPaA 2004c). Thus, long-term project operations could account for as many as 438 total jobs. The employment multipliers for operational jobs are larger than those for construction jobs because the operating period is much longer than the construction period and, therefore, would likely result in more workers permanently relocating to the area.

The following subsections discuss the potential socioeconomic impacts of the proposed project, particularly those associated with direct, indirect, and induced employment during project construction and operations.

4.1.7.1 Population

Because the proposed facilities would be located within a 1-hour drive of some large labor markets (i.e., Reading, Allentown, and Wilkes-Barre), a minimal number of workers would be expected to move to the project locale during construction and operation. Therefore, this analysis assumes that most of the construction and operations workers already reside in the *east central Pennsylvania* region and would commute daily from their homes to the project site. Although workers would be unlikely to relocate from outside the project region, this analysis assumes as a conservative estimate that 10% of the peak construction work force (100 workers) and 60% of the operations work force (90 workers) would relocate. The analysis assumes a lower percentage of relocating workers for construction than for operations because the construction period would last only 30 months (i.e., the shorter the work period, the less likely that workers would relocate).

Past experience with large, multi-year power plant construction and refurbishment projects indicates that approximately 60% of the in-migrating work force is accompanied by family, while the remaining 40% is not (NRC 1996). However, for this relatively small, 30-month construction project, a more reasonable assumption is that only 40% of the construction workers relocating to the area (40 workers) would be accompanied by family. This analysis assumes that a higher percentage of the operational workers relocating to the area (75% or 68 workers) would be accompanied by family because the facilities' operating period would be much longer than the construction period.

Assuming that 60 construction workers would relocate without families and that 40 construction workers would relocate with families, and assuming an average family household size of 2.48 persons for Pennsylvania (U.S. Census Bureau 2004b), the permanent population in the project area would increase by about 160 as a result of direct construction employment. This population growth would represent 0.11% of Schuylkill County's population in 2000.

Similarly, assuming that 68 operations workers would relocate with families and that 22 operations workers would relocate without families, and assuming an average family household size of 2.48 persons, the permanent population in the project area would increase by about 190 as a result

of direct operations employment. This population growth would represent 0.13% of Schuylkill County's population in 2000.

The indirect and induced jobs that could be created would be less specialized than the direct construction and operations jobs, and would be even more likely to be filled by existing area residents. Accordingly, this analysis assumes that none of the indirect or induced work force would relocate to the project area during project construction or operations.

The potential impacts of project-related population growth are discussed below in Sections 4.1.7.3 (Housing), 4.1.7.4 (Water and Wastewater Services), and 4.1.7.5 (Public Services).

4.1.7.2 Employment and Income

The 1,689 total jobs (1,000 direct, 351 indirect, and 338 induced) that could be created during the peak construction period (Section 4.1.9) would represent 2.5% of the total labor force in Schuylkill County in 2000. Similarly, the 438 total new jobs (150 direct, 115 indirect, and 173 induced) that could be created during project operations would represent 0.6% of the county's total labor force. Because most of the direct, indirect, and induced jobs during construction and operations would be filled by workers who currently reside within a 1-hour driving distance of the proposed facilities, project construction would have a short-term positive effect on employment in the *east central Pennsylvania* region, and project operations would have a long-term positive effect on employment in the region.

Because most of the construction and operations work forces would reside in the project region, project wages would have a positive effect on total and per capita income. Based on the types and numbers of occupations that would make up the construction work force and the average annual salaries for those occupations in Schuylkill County (PDLI 2003), the total direct payroll during the 6-month peak construction period would be close to \$20 million. The total direct payroll for the entire 30-month construction period would be at least twice as large as this \$20 million figure. Further, assuming only the current minimum wage in Pennsylvania of \$5.15 per hour (U.S. Department of Labor 2004) and 2,000 hours per work-year, the total payroll generated by the indirect and induced jobs (356) over the 30-month construction period would be over \$9 million.

Similarly, assuming that 150 employees would make up the operations work force, and that the average annual salary for a "power plant operator" in Schuylkill County is \$40,014 (PDLI 2003), the annual direct payroll during project operations would be at least \$6 million. Further, assuming only the current minimum wage in Pennsylvania (\$5.15 per hour) and 2,000 hours per work-year, the annual payroll generated by the indirect and induced jobs (288) during project operations would be nearly \$3 million.

Overall, construction of the proposed facilities would have short-term positive effects on employment and income in the *east central Pennsylvania* region. Project operations would also have positive effects on employment and income and, provided that the demonstration is successful (Section 5), these effects would last longer than the effects of construction. The project's positive effects on employment and income would contribute to the region's economic viability.

4.1.7.3 Housing

Because most of the direct, indirect, and induced jobs during project construction and operations would be filled by workers who currently reside within a 1-hour driving distance of the proposed facilities, demand for housing in Schuylkill County would not increase appreciably. Housing for the 100 new construction-related households (i.e., the workers relocating with and without families) assumed as an upper bound in this analysis would represent 1.4% of the 7,276 vacant housing units in Schuylkill County in 2000. Similarly, the 90 new operations-related households would represent 1.2% of the county's vacant housing in 2000. These levels of increased demand would not be likely to have an adverse effect on the availability or cost of housing in Schuylkill County, particularly given the county's population decline since 1990.

4.1.7.4 Water and Wastewater Services

Because most of the direct, indirect, and induced jobs during project construction and operations would be filled by workers who currently reside within a 1-hour driving distance of the proposed facilities, demand for water and wastewater services in Schuylkill County would not increase appreciably. Mahanoy Township Authority and the Schuylkill County Municipal Authority have abundant water supplies (Section 3.7.4), which could easily meet the additional demand from 100 new construction-related households and 90 new operations-related households. Because of planned upgrades by the Greater Pottsville Area Sewer Authority, the additional demand from the new households would not exacerbate existing problems with the provision of wastewater services in Pottsville (Section 3.7.4).

4.1.7.5 Public Services

Police Protection

As discussed in Section 4.1.7.1, population growth associated with construction and operation of the proposed facilities would be minimal, representing only about 0.1% of Schuylkill County's population in 2000. Given such a small population increase, particularly in the context of an ongoing population decrease in Schuylkill County (Section 3.7.1), construction and operation of the facilities would not create an additional need for police protection. In the unlikely event of an accident associated with plant operations or the shipment of materials, additional police resources would probably be required, most likely from Pottsville and the Pennsylvania state police.

Fire Protection and Emergency Medical Services

As with police protection, the relatively small population increase and housing demand associated with construction and operation of the proposed facilities would not create an additional need for fire protection or emergency medical services.

In the unlikely event of an accident associated with plant operations or the shipment of materials, additional fire protection and emergency medical services would probably be required. The Schuylkill County Emergency Management Agency (SCEMA) would be responsible for evacuating nearby residents if necessary. SCEMA, in conjunction with the Pennsylvania Emergency Management Agency (PEMA), is in the process of developing a hazard mitigation plan for Schuylkill County. The plan will cover the hazards which are most likely to affect the county and pose a threat to its inhabitants, including hazardous materials, transportation, and wildfires (SCEMA 2006).

Schools

Because population growth associated with construction and operation of the proposed facilities would be minimal, little (if any) effect on local schools would be experienced. This outcome is reinforced by Schuylkill County projections, which indicate that by 2013 the Mahanoy Area School District's total enrollment will decrease by more than 39% for all grade levels, and the Pottsville Area School District's enrollment will decrease by 5% for kindergarten–8th grade and by 23% for 9th–12th grade (Section 3.7.5.3).

Health Care

Given the small population growth associated with construction and operation of the proposed facilities, particularly in the context of an ongoing population decrease in Schuylkill County (Section 3.7.1), construction and operation of the facilities would not create an additional need for health care facilities. In the unlikely event of an accident associated with plant operations or the shipment of materials, the local health care facilities could be strained, and some accident victims might need to be transported out of the immediate area for treatment. The extent of the impact on local health care facilities and the need to transport patients elsewhere would depend on the type and size of the accident.

4.1.7.6 Local Government Revenues

The proposed facilities would be located in *Mahanoy Township within* one of Pennsylvania's designated Keystone Opportunity Zones, which are geographical areas that receive local and state approval for tax abatements for the purpose of stimulating economic development. Because of this designation, local real estate taxes (to Schuylkill County, Mahanoy Township, and the Mahanoy Area School District) for the proposed project site and taxable improvements would not be due until *10 years after the completion of project construction*. Using 2003 real estate tax rates and a projected assessed value on land and improvements, the facilities' annual real estate tax payments would be *at least \$73,000, but would not start until 2019 at the earliest*.

4.1.7.7 Environmental Justice

As discussed in Section 3.7.7, Schuylkill County and eight of the nine census tracts within 3 miles of the proposed facilities have lower minority percentages than the United States and Pennsylvania. For Census Tract 7, however, significant minority populations reside at the Mahanoy and Frackville State Correctional Institutions. The minority inmate populations in these correctional facilities represent "environmental justice" populations to which the adverse impacts of constructing and operating the proposed facilities could be distributed disproportionately. However, serious air quality and health impacts to this population would not be expected, as discussed in Section 4.1.2.1.

Schuylkill County's population percentage below the poverty level is lower than that of Pennsylvania and the United States. However, two census tracts near the site of the proposed facilities have relatively high poverty rates (Table 3.7.5). Census Tracts 5 and 6 have *low-income population percentages* that exceed those of both Pennsylvania and the United States. Therefore, the *low-income* populations in Census Tracts 5 and 6 represent "environmental justice" populations to which the adverse impacts of constructing and operating the proposed facilities could be distributed disproportionately. *However, serious* air quality, water quality, and health impacts to these populations would not be expected, however, as discussed in Sections 4.1.2, 4.1.4, and 4.1.9. *Therefore, the proposed action would not result in disproportionately high and adverse impacts to minority or low-income populations.*

4.1.7.8 Transportation

Roads

All of the 1,000 workers during the 6-month peak construction period would access the project site from State Route 1008 (Morea Road). Most of these workers would access State Route 1008 from its intersection with State Route 61 in the town of Frackville. For this assessment, it is assumed that the construction workers would commute to and from the project site each day. For the United States, average vehicle occupancy to and from work in 2001 was 1.1 persons per vehicle (DOE 2004). In Pennsylvania, carpools of two or more persons comprise only 12% of total vehicle occupancy for workers, while vehicles with one person comprise 88% (U.S. Census Bureau 2005). For this assessment, however, we assume 2.0 persons per vehicle for the construction work force because (1) many of the workers would be driving from other parts of the region outside of the immediate project vicinity and would be more likely to carpool and (2) the project proponents would encourage carpooling during construction to help reduce impacts to traffic flow and safety on the local road network. Thus, as an upper bound, about 1,000 additional vehicle trips (500 to the site and 500 from the site) would be generated each day during the peak construction period.

Average daily traffic (ADT) on State Route 61 in Frackville is 10,186 vehicles, and ADT on State Route 1008 near the Gilberton Power Plant is 4,486 vehicles (Section 3.7.8.1). The 1,000 additional daily vehicle trips for workers during the peak construction period would represent increases of 10%

and 22% over existing traffic on State Route 61 and State Route 1008, respectively. Increases of this size on State Route 61 and State Route 1008 would likely cause traffic congestion and have an appreciable impact on traffic flow and safety during morning and afternoon commutes (Dave Gruber, Pennsylvania Department of Transportation District 5, personal communication to James W. Saulsbury, ORNL, May 26, 2004). In addition to these construction workers' vehicles, the number of construction delivery trucks accessing the project site from State Route 61 and State Route 1008 would increase. Because most of this construction-related traffic would occur during peak morning and afternoon drive times, impacts to traffic flow and safety on State Route 61 and State Route 1008 would be particularly acute. Also, this relatively large increase in traffic volume would result in noise, dust, and traffic congestion impacts affecting residents along the transportation corridor and an increased need for maintenance and repair of the local road network. WMPI has committed to contacting the Pennsylvania Department of Transportation to discuss potential options for mitigating the project's impacts on traffic safety and flow, including signaling, road widening, and scheduling work hours and/or deliveries to avoid periods of heavy traffic. WMPI would also consult with the Pennsylvania Department of Transportation (PennDOT) on minimizing noise, dust, and traffic congestion impacts to residents along the transportation corridor and to providing mitigation for the project's impacts on local road maintenance and repair.

During the demonstration and long-term project operations, all of the 250 and 150 workers, respectively, would access the facilities from State Route 1008 (primarily via State Route 61 in Frackville). It is assumed for this assessment that each vehicle would carry one operations worker. Thus, as an upper bound, about 500 additional vehicle trips (250 to the site and 250 from the site) would result each day from workers commuting during the demonstration, while about 300 additional vehicle trips (150 to the site and 150 from the site) would result each day from workers commuting during long-term operations. In addition, approximately 104 truck trips per day (52 to the site and 52 from the site) would deliver culm to the site, 40 truck trips per day (20 to the site and 20 from the site) would bring limestone, 22 truck trips per day (11 to the site and 11 from the site) would transport waste material to an offsite landfill, and 2 truck trips per day (1 to the site and 1 from the site) would transport sulfur from the site (use of petroleum coke as an additional feedstock could increase sulfur transportation requirements to as many as 7 round trips per day). Although liquid fuels produced by the proposed facilities are planned to be shipped from the facilities solely by rail, if the fuels were to be shipped by truck, about 80 vehicle trips would be required daily (40 to the site and 40 from the site). The impacts of operations-related traffic would be less severe than those of construction-related traffic but would be more long lasting. As discussed for the construction period, this increase in traffic volume would result in noise, dust, and traffic congestion impacts affecting residents along the transportation corridor and an increased need for maintenance and repair of the local road network. WMPI has committed to contacting the PennDOT to discuss potential options for mitigating the project's impacts on traffic safety and flow, including signaling, road widening, and scheduling work hours and/or deliveries to avoid periods of heavy traffic. WMPI would also consult with the PennDOT on minimizing noise, dust, and traffic congestion impacts to

residents along the transportation corridor and providing mitigation for the project's impacts on local road maintenance and repair.

Railways

The proposed facilities would affect the local rail system because the project's liquid fuels would be shipped by rail. Rail transport would require the construction of product pipelines to transport materials to the nearest railroad siding in Gilberton, about 1 mile from the main plant area, and construction of storage and loading facilities capable of filling approximately eight tank car loads of product per day. Filled tank cars would be stored on a siding. Once a week, a new supply of empty tank cars would be delivered, and a train of filled tank cars would be assembled and moved off the site. Rail shipments of this magnitude would not have adverse impacts on the local rail system (James G. Raffa, Vice President, Traffic, Reading Blue Mountain & Northern Railroad Company, personal communication to James W. Saulsbury, ORNL, September 9, 2004). Potential accidents associated with transport of liquid fuels are discussed in Section 4.1.9.1.

4.1.7.9 Cultural Resources

In compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, DOE has consulted with the Pennsylvania *State Historic Preservation Office* (SHPO) regarding a determination of the potential for impacts associated with the proposed facilities on any historic resources that may be listed in or eligible for the *National Register of Historic Places* or that may have local importance. Impacts from construction and operation of the facilities would not be likely because the SHPO has stated that no historic or archaeological properties are listed or eligible for listing on the *National Register* in the project area (Appendix B). The SHPO has further stated that DOE's responsibility for consultation is complete. However, the SHPO would be notified if any historic or archaeological properties located at or near the project site are detected.

4.1.8 Waste Management

4.1.8.1 Construction

Initial site grading would include land clearing, grubbing, stripping, excavation, and placement of fill to establish rough grading elevations. Excavated soil would be used onsite for fill. Topsoil and other soil containing organic material would be stockpiled on the site and used in final grading. Some timber could be salvaged and sold for pulpwood or firewood, but the majority of the removed vegetation, including tree stumps, would be managed as waste. Open burning on the site would minimize the labor and transportation required to dispose of this material, but would have short-term impacts in the surrounding area due to smoke, odors, and increased airborne particles (Section 4.1.2.1). To minimize the potential for fire to spread to nearby vegetation, burning would not be scheduled during drought conditions in which advisories have been issued by the Pennsylvania Department of Environmental Protection. Alternatively, this material could be taken to a commercial

composting facility for recycling. Composting facilities that accept land-clearing debris are located in Robesonia (Berks County), Bethlehem, and the Philadelphia area (Section 3.8).

Waste from construction of the proposed facilities would include excess materials, metal scraps, and pallets, crates, and other packing materials. Excess supplies of new materials would be returned to vendors, retained for future use, or transferred in settlement with subcontractors (who could retain the items for use in future projects). Surplus paint and other consumables, partial spools of electrical cable, and similar leftover materials would also be retained for possible future use in maintenance, repairs, and modifications (Section 2.1.6.3).

Metal scrap not suitable for future use in the facilities would be collected in dumpsters for resale to scrap dealers or recyclers. The volume of metal scrap would be no more than one dumpster per month during the period of peak scrap generation, with less generated during the first six months and last three months of construction (Section 2.1.6.3).

Packaging materials and nonmetal components broken during installation would be collected in dumpsters for offsite disposal. The largest volume of solid waste requiring disposal would be packaging material, including wooden pallets and crates, support cradles used for shipping of large vessels and heavy components, and cardboard and plastic packaging. The rate of generation for packaging waste would be up to two truckloads per month (estimated to be about 18 cubic yards or 18 tons per month) during construction (Section 2.1.6.3). The volume of broken nonmetal components would be much smaller. The quantity and character of other wastes would be typical of any work site. Office waste paper would be collected for recycling, and miscellaneous work site waste (such as garbage from workers' meals) would be collected for offsite disposal.

The commercially available municipal solid waste landfills in the region (Section 3.8) should have ample capacity to receive and dispose of project construction wastes. Because project construction waste quantities would be small in comparison with the landfill capacities and waste quantities routinely handled at these sites, management of these wastes should have negligible impact.

During construction, no hazardous waste generation would be anticipated (Section 2.1.6.3).

4.1.8.2 Operation

Solid Waste

Solid wastes and byproducts generated by the operation of the proposed facilities would include gasifier slag, fine solids, elemental sulfur, sludges from water and wastewater treatment, and spent catalysts, absorbents, resins, and filtration materials (Section 2.1.6.3). In addition, beneficiation of culm for use in the proposed facilities would generate solid waste consisting of waste rock and soil.

Slag generated by the gasifier would be a vitrified (glass) silicate material formed when noncombustible solids found in coal and culm are heated past the melting point and then cooled rapidly. No organic compounds would be expected in this material. Slag, which would be black in color and granular (sand-like) in form, would be generated at a rate of *at least* 1,600 tons per day (wet weight) or 800 tons per day (dry weight). One day's slag production would cover an acre of land

to a depth of about 1 ft. (Because of the low ash content of petroleum coke, its use as an additional feedstock, as outlined in Section 2.1.2 and Appendix G, would reduce the facilities' production of gasification slag.)

Commercial uses would be sought for the gasifier slag, which is projected to have low bulk density, high shear strength, and good drainage and filtering characteristics. Several potential uses have been identified for this material, including lightweight construction aggregate, asphalt roofing shingle granules, blasting grit, and pipe bedding material (SAIC 2002). However, markets for this material have not yet been established *and the regulatory acceptability of potential beneficial uses has not been determined (Section 7.2)*. Any slag that is not used commercially *is expected to* be used as fill material for surface mine reclamation at and near sites where culm would be obtained (Section 2.1.6.3).

Contaminants potentially can leach into groundwater or surface water when solid byproducts are used in the environment. Requirements of the Pennsylvania residual waste management regulations (25 Pennsylvania Code Chapter 287) are intended to prevent or reduce the potential for adverse impacts from leaching of wastes (Strock 1996). *Residues* must be characterized for *physical properties*, chemical composition, and to verify that they meet regulatory criteria for leachability (*Section 7.2*). Materials must be retested periodically to demonstrate that they continue to meet the criteria. Coal combustion residues may be used as fill only in coal mining areas (active or abandoned) or coal refuse disposal sites. Placement must be at least 8 ft above the regional water table, but the regulations provide for exemptions (e.g., placement in mine pools) upon demonstration that no groundwater contamination would occur. Compliance with these regulations would minimize the potential for adverse impacts to water quality from management of the slag residue.

Characterization of coal ash from the existing Gilberton Power Plant provides a basis for predicting the characteristics and leaching behavior of coarse slag from the proposed facilities. Because both facilities would use culm from the same sources, the slag and ash should have similar chemical composition, but the vitrified gasifer slag would have different physical and mechanical properties and would be less leachable than the ash, which is formed at lower temperatures. Table 4.1.2 presents results of chemical analysis and leachability testing of Gilberton Power Plant ash. Leachability *has been* tested using the Synthetic Precipitation Leaching Procedure (SPLP), which simulates the potential effects of leaching under acidic conditions typical of rainfall in the eastern United States. Testing indicates that the ash is highly alkaline (measured leachate pH typically is greater than 10.0, although a few samples have been acidic), a desirable characteristic for reclamation of acidic mine wastes. Concentrations of dissolved constituents in the ash leachate usually are below maximum acceptable concentrations for beneficial use, as specified under Pennsylvania residual waste management regulations; the only exceptions have been the aluminum concentrations in several ash samples tested between 1988 and 1990 (Hornberger et al. 2004). However, for many constituents the upper end of the range of ash leachate concentrations exceeds the applicable drinking water Maximum Contaminant Level Goal (MCLG) or primary or secondary drinking water standards (for substances without MCLGs). Due to the physical differences between

slag and ash, leaching of slag from the proposed facilities would be expected to result in much lower contaminant concentrations. Thus, the risk of adverse impacts to groundwater quality from using this material in mine reclamation would be negligible. However, the relatively inert slag also would have less value as a source of alkalinity for acidic mine reclamation.

About 200 tons of fine solids (dry basis) would be generated each day. Some of this material might be captured and returned to the gasifier for energy recovery (SAIC 2002), but the majority *is expected to* be used in a permitted ash disposal area on WMPI land as part of mine reclamation (Section 2.1.6.3), subject to the same residual waste regulations that would govern management of the slag. The fine solids would not be as chemically inert as either slag or power plant bottom ash and would contain 11% carbon (dry basis), as either unburned carbon or other coal-derived organic constituents. The potential for impacts to water quality from using this material in mine reclamation would be larger than from similar use of the slag, but compliance with the residual waste regulations would minimize the potential for adverse impacts to water quality. Although it is expected that the majority of fine solids would be applied on land as part of mine reclamation, this assessment also considers the possibility that the material would not meet regulatory criteria for use in mine reclamation, and therefore would be taken for disposal in a commercial landfill, such as the facilities identified in Section 3.8.

Sludges from treatment of raw water and wastewater would total about 24 tons per day. Treatment of cooling water (to remove 1,700 lb per day of iron and manganese) would generate about 11 tons per day of wet sludge, while wastewater treatment would produce about 13 tons per day of wet sludge. Provided that the requirements of the Pennsylvania residual waste management regulations are met, these sludges would be placed in Mahanoy Creek valley on WMPI land that is permitted for disposal of coal byproducts under *coal surface mining* permit 54850202, issued *to B-D Mining* by the Pennsylvania Department of Environmental Protection (Section 3.8). Although the sludges would likely qualify under Pennsylvania regulations for placement on WMPI land as part of mine reclamation, this assessment also considers the possibility that both types of sludges would be taken for disposal in a commercial landfill.

The placement of the proposed facilities' solid wastes and byproducts, *together with waste rock* and soil from culm beneficiation, on lands that were previously mined or covered with culm banks would contribute to reclamation of surface-mined lands (i.e., contour grading and vegetation establishment) (Section 4.1.6.1). Reclamation activities and needs in the vicinity could easily absorb the volume of material that would be generated during the 3-year demonstration (Section 5 discusses corresponding potential impacts associated with commercial operation following the demonstration). Standard engineering practices such as silt fencing and straw bales would be employed during reclamation to prevent adverse impacts to surface waters from runoff, erosion, and sedimentation. Earthen berms or dikes could be needed to provide effective management for the large quantities of wet sludge. Periodic inspections by Pennsylvania Department of Environmental Protection personnel would help in monitoring the integrity of engineering controls to assure their effectiveness (Section 3.8).

Table 4.1.2. Chemical analysis of Gilberton Power Plant coal ash and Synthetic Precipitation Leaching Procedure (SPLP) leachate

Constituent	Ash concentration (mg/kg dry weight) ^a	Leachate concentration (mg/L) ^a	Range of leachate concentration (mg/L) ^b	Median of leachate concentration (mg/L) b	Maximum acceptable leachate concentration (mg/L) ^c	Applicable drinking water criterion (mg/L)
Aluminum	36,300	3.14	ND^{d} - 23.9	2.24	5.0	0.2^{e}
Antimony	4	< 0.04	$N\!A^f$		0.15	0.006^{g}
Arsenic	18.1	0.045	ND - 0.25	0.02	1.25	0.01^{h}
Barium	296	0.04	ND - 0.59		50	2^g
Boron	61	0.06	ND - 0.65		31.5	i
Cadmium	0.9	< 0.005	ND - 0.05		0.13	0.005^{g}
Chromium	57	0.08	ND - 0.32		2.5	0.1^{g}
Cobalt	NA	NA	ND - 0.07		_	i
Copper	51	0.02	ND - 0.13		32.5	1.3^{g}
Iron	24,300	0.21	ND - 1.05	0.16	7.5	0.3^{e}
Lead	58	0.05	ND - 0.31		1.25	0.005^{j}
Manganese	120	< 0.005	ND - 0.73		1.25	0.05^{e}
Mercury	0.2	< 0.0002	ND		0.05	0.002^{g}
Molybdenum	<1.0	0.05	ND - 0.72		4.38	i
Nickel	21	< 0.01	ND - 0.16		2.5	i
Selenium	8.5	0.018	ND - 0.21		1.0	0.05^{g}
Silver	NA	NA	ND - 0.05		_	0.1^e
Zinc	37	0.05	ND - 4.46		125	5^e
Chloride	NA	1.78	NA		2,500	250^e
Sulfate	NA	502	NA		2,500	250^e

^aSource: WMPI PTY, LLC. Analysis reported by Hawk Mountain Labs, Inc., West Hazleton, PA, December 12, 2003.

^bSource: Analysis reported to Pennsylvania Department of Environmental Protection, 1988-1999 (Hornberger et al. 2004).

^cPennsylvania residual waste management regulations (25 Pennsylvania Code Chapter 287). For most dissolved metals, maximum acceptable concentrations were set at 25 times the applicable drinking water Maximum Contaminant Level Goal (MCLG; a health-based criterion established by federal and state drinking water regulations) or secondary drinking water standard. For chloride and sulfate, the maximum concentrations are 10 times the secondary drinking water standard.

 $^{^{}d}ND = Not detected.$

^eSecondary drinking water standard.

 $^{{}^{}f}NA = Not analyzed.$

gMCLG.

^hPrimary standard effective January 2006 (no MCLG); previously the standard was 0.05 mg/L.

ⁱNot currently regulated. For nickel, MCLG and primary standard were set at 0.1 mg/L until remanded in

^j Pennsylvania primary drinking water standard (no MCLG).

Several minor waste streams are expected to require disposal in an offsite commercial landfill (Section 2.1.6.3). Additionally, if fine solids or sludges from the facilities failed to meet criteria for land application, they could require disposal in an offsite commercial landfill. Commercial landfill capacity in the region appears to be sufficient to handle the additional waste volumes (Section 3.8). However, management of any project residue at a Pennsylvania commercial landfill would require specific approval from the Pennsylvania Department of Environmental Protection (Section 7.2) and could require modifications of operating procedures to avoid adverse effects on landfill operations. Disposal of the fine solids, sludges, and other waste streams expected to be sent to a commercial *landfill* would increase average daily waste volumes at either of the two nearest landfills (Section 3.8) by more than 10%. If sludges were transported to commercial landfills routinely, additional dewatering would probably be conducted to reduce weight and the potential for release of water after delivery. Special handling might also be required before shipment or within the landfill to control the release of water, which could affect the quantity and characteristics of landfill leachate. At least 11 daily truck trips would be required to deliver fine solids and sludge to the landfill. Roundtrip travel distance would be more than 20 miles to the nearest landfill (Commonwealth Environmental Services facility in Foster Township) and more than 50 miles to another facility.

At least 13 tons per day of byproduct elemental sulfur would be produced and sold commercially. Use of petroleum coke as 25% of the feedstock (Section 2.1.2; Appendix G) would increase the production of byproduct sulfur due to the higher sulfur content of petroleum coke. Sulfur has numerous uses in agriculture and industry. More than 10 million tons are consumed in the United States each year. This consumption exceeds domestic production, all of which is byproduct material from environmental control systems (Ober 2002). Given this domestic situation, the market should easily absorb the quantity (about 4,000 tons) that the proposed facilities would generate each year of the demonstration.

None of the proposed facilities' solid wastes and byproducts would be expected to be hazardous as defined under RCRA. The EPA's Toxicity Characteristic Leaching Procedure test would be performed to verify this expectation. Any wastes subject to RCRA hazardous waste regulations would be handled in accordance with standard procedures similar to those currently implemented at the Gilberton Power Plant.

Some toxic metals present in coal as trace constituents are likely to be captured in the catalysts, adsorbents, resins, and filtration materials that would be returned to their manufacturers for regeneration or other processing. Although these materials would not be hazardous wastes, processing of these materials may generate hazardous wastes subject to RCRA. Management of any hazardous wastes generated at a manufacturer's offsite facility would be the responsibility of the manufacturer and would utilize the capacity of existing licensed treatment, storage, or disposal facilities.

Liquid Waste

Operation of the proposed facilities would generate several different liquid wastes requiring treatment or control. Liquid wastes from the gasification and liquefaction processes would hold various impurities collected in processing, off-gas cleaning, and solid waste processing. Process wastewaters would have high organic loadings and would require treatment for substances including methanol and other alcohols, formates, ammonia, formic and acetic acids, cyanides, sulfides, and chlorides. Stormwater runoff collected from the facilities, coal piles, and other areas would require removal of oil and grease and other contaminants. Wastewater from *reverse osmosis treatment and* demineralization of mine pool makeup water would have high concentrations *of* dissolved substances removed from the mine pool. Contaminants in wastewater released from the cooling water system would include proprietary biocides, corrosion and scale inhibitors (such as phosphates), chlorine, and other substances injected into the makeup and circulating streams to inhibit corrosion and fouling, together with high concentrations of dissolved solids (such as sulfates) not removed during initial water treatment.

Several wastewater collection and treatment units would be used to manage these liquid waste streams, based on technologies used successfully in other industries. Stormwater collected from process areas and stormwater from parking lots and other portions of the site not used for processing or materials storage would be collected in two separate lined retention basins. Wastewater from the gasification and liquefaction processes would be combined with stormwater from process areas in an equalization basin, then routed to a series of oil-water separation units where droplets of oil and grease would be recovered and oily sludge would be collected for disposal or recycling to the gasification process. Effluent from this stage of treatment would be routed to a biological treatment unit that would combine aeration with clarification in order to treat wastewater with high levels of chemical and biochemical oxygen demand. WMPI (2005c) proposes use of the Advent integrated activated sludge system (Dorr-Oliver EIMCO, undated). This unit would be designed to consume the organic compounds and nutrients in the wastewater, yielding treated effluent for discharge and a biological sludge for disposal. Treated effluent would be mixed with non-process-area stormwater and non-oily wastewater streams (including cooling tower blowdown, boiler blowdown, and wastewater from reverse osmosis treatment and demineralization of mine pool water) in an equalization basin for final settling and testing prior to discharge to a tailings pond in Mahanoy Creek valley.

Potential environmental impacts from liquid waste management would include *impacts to water* resources receiving effluent discharges, particularly of incompletely treated effluents (see Section 4.1.4.1), objectionable odors, and the possibility of accidents involving fire or explosion in oil-water separation units. Potential impacts from odor would be controlled by treating all process wastewater within enclosed facilities prior to discharge to the final equalization basin. Treatment system upsets (e.g., if fluctuations in wastewater characteristics were to cause a die-off of microorganisms in the biological treatment unit) could result in release of incompletely treated water, causing odor problems and water quality degradation off the site (Section 4.1.4.1). The potential for upsets could be

minimized by designing the system with ample reserve capacity, selecting treatment units that are demonstrated to tolerate a wide range of wastewater characteristics, and controlling inflows to the treatment system to maintain consistent wastewater characteristics. Potential for explosion in oilwater separation units could be minimized by using a nitrogen gas blanket over these units.

4.1.9 Human Health and Safety

4.1.9.1 Public Health

During construction of the proposed facilities, potential health impacts to the public could result from fugitive dust emissions into the atmosphere (Section 4.1.2.1). However, these emissions would occur over a relatively short time period. WMPI would regularly use water spray trucks to dampen the material in construction areas to suppress the generation of dust.

Another potential health impact to the public would be associated with operational air emissions from the proposed facilities, including SO₂, NO_x, PM-10, CO, and hazardous air pollutants. Schuylkill County currently experiences a higher average annual rate of deaths than surrounding counties and Pennsylvania as a whole (Section 3.9.1). Therefore, any increase in regional air emissions could potentially be harmful to sensitive members of the general population. However, all maximum ambient concentrations of criteria pollutants from the proposed facilities were estimated to be less than their corresponding significant impact levels, and Air Quality Program Permit No. 54-399-034, issued by the Pennsylvania Department of Environmental Protection for the proposed facilities, establishes maximum allowable limits to ensure that the proposed facilities would be a minor new source of hazardous air pollutants (e.g., mercury) under the National Emissions Standards for Hazardous Air Pollutants regulations (Section 4.1.2.2).

The interaction between air emissions and toxic exposures from other sources of pollution depends on the chemical species and the route of exposure. While many potential air pollutants exert their toxic effects via inhalation with the lungs/respiratory system frequently being the target, there are some potential pollutants that exert their toxic effects whether inhaled, contacted with the exposed skin, or ingested. Benzene provides an example of a substance that can be present in both air and water and can manifest toxic effects from skin absorption, ingestion, and inhalation. To estimate the potential risk, an emission factor for benzene from a facility believed to produce similar emissions and EPA's inhalation risk factor were used to calculate the lifetime risk of cancer to an individual from inhaling this benzene emission; that risk is estimated to be a little over 1 in 50 million. Even if all sources of benzene exposure taken together multiplied the risk 50 times (an unlikely circumstance), the lifetime risk would be 1 in 1 million.

The quantities of flammable and hazardous materials produced and stored at the facility increase the potential for accidents during operations. The protection of public health from potential accidents associated with this facility is regulated by EPA and would be addressed as part of compliance with 40 CFR 68 and 29 CFR 1910.119 (Section 7.1). This process includes hazard identification, hazard analysis, accident identification, and accident analysis. These analyses are to

address in detail the potential consequences from a worst-case release scenario from the facility to the nearest off-site member of the public. These investigations and analyses, along with identified process controls, procedures, training, and audits, are to be incorporated into a Risk Management Plan that is submitted to EPA. In addition to the Risk Management Plan, an Emergency Response Program is to be developed and included in the Risk Management Plan. The necessary investigations and analyses required by these regulations have not yet been completed for this facility.

Although unlikely, potential impacts to health and safety of the workers and the public from accidents at the proposed facility could result from releases of toxic or explosive chemicals to the atmosphere. These chemicals could include H_2S , SO_2 , CO, HCl, HF, benzene, arsenic, mercury, beryllium, synthesis gas, fuel gas, tail gas, oxygen, methanol, sulfuric acid mist, ammonia, and natural gas. These chemicals are associated with the Shell gasification technology or the SASOL Fischer-Tropsch liquefaction technology. Based on the existing operating experience of the technologies to be utilized in the proposed facility, the potential risks from accidents during facility operations are expected to be greatest to workers. Occupational health and safety standards under 29 CFR 1910.119 require the protection of workers from hazardous chemicals above threshold quantities.

In addition, 40 CFR 68 requires the project operator to develop measures to protect the public from hazardous chemicals above threshold quantities. The Risk Management Plan required by 40 CFR 68 includes an offsite consequence analysis for a worst-case release scenario for each regulated toxic substance above the threshold quantity and an alternative release scenario to represent all regulated flammable substances held above the threshold quantity. The population at risk must be identified in the Risk Management Plan, and appropriate passive and active mitigation must be considered in the analysis. Given these protections, the probability of a catastrophic accident involving a fire or explosion resulting in a release of toxic chemicals affecting members of the public is remote.

The Shell gasification technology has been under commercial development and operation for over 40 years. There are currently over 160 commercial plants operating that utilize this technology. As with most industrial technologies, accidents have occurred over this period of time, some of which have resulted in fatalities to workers. The largest reported accident was associated with an explosion of the air separation unit at a plant in Malaysia with a capacity of 14,500 barrels/day. The plant was closed from 1997-2000 while repairs were made and additional controls were introduced. No reports of injuries or fatalities to the public from catastrophic or industrial accidents associated with the Shell gasification technology have been identified.

The SASOL Fischer-Tropsch liquefaction technology has been under commercial development and operation for over 20 years, primarily in South Africa. The capacity of the plants in South Africa exceeds 150,000 barrels/day. Like the Shell gasification technology, accidents have occurred during this period, with the most recent occurring from a gas leak and fire in 2005 that injured 19 workers. This accident occurred during a transfer of chemicals from the plant to a tanker. The

plant was shut down while an investigation was completed. Following the investigation, additional controls were implemented in response to the findings from the investigation. As with the Shell gasification technology, no reports of injuries or fatalities to the public from catastrophic or industrial accidents associated with industrial operations of the SASOL Fischer-Tropsch liquefaction technology have been identified.

The proposed facility is designed to have a capacity of 5,000 barrels/day, which is significantly less than the capacities of the commercially sized components being utilized. Consequently, there would be smaller quantities of toxic or hazardous materials than at commercial-sized facilities. While the combination of these two technologies could be considered to lead to an increase in the risk of facility operations, the operations experience of both technologies has not resulted in significant consequences to the public. Since the proposed facility is a demonstration project, additional monitoring and audits by EPA can be expected as part of the Risk Management Plan, which contribute to a reduction in risk of facility operations. Consequently, the risks to the public from facility operations are not anticipated to be significant.

The facility would have firefighting and emergency response capabilities included in the Emergency Response Program to mitigate the consequences of any fires, hazardous materials releases, or medical emergencies. Emergency response personnel would be capable of responding quickly and effectively to minimize personnel injury, environmental damage, and property damage from accidents. Emergency response personnel would also be trained to respond properly in the handling of hazardous chemicals, catalysts and flammable materials utilized and produced in the facility.

While no credible emergencies have been identified at this time that would require the rapid emergency evacuation of the prison, this type of event could be identified in the preparation of the Risk Management Plan and the Emergency Response Program. Should the need for rapid evacuation of the prison be identified in the Risk Management Plan, the necessary procedures and safeguards would be developed to protect public health and safety. An emergency operations plan for Mahanoy State Correctional Institution that includes procedures for evacuation of inmates and employees in the event of an emergency has been developed (Major Dennis Durant, Chief of Security, Pennsylvania Department of Corrections, e-mail to Cheri Bandy Foust, Oak Ridge National Laboratory, March 15, 2006). The evacuation of approximately 2,300 inmates would be accomplished by exercising existing agreements with bus services in the area. Logistical considerations with other prisons for relocating inmates would require approximately 24 hours. The movement of inmates would require an additional 24 to 48 hours (Ed Martin, Superintendent's Assistant, Mahanoy State Correctional Institution, personal communication to Robert Miller, ORNL, March 16, 2006). As noted in Section 4.1.7.5, the Schuylkill County Emergency Management Agency (SCEMA) would be responsible for evacuating nearby residents, in necessary. SCEMA, in conjunction with the Pennsylvania Emergency Management Agency, is in the process of developing a hazard mitigation plan for Schuylkill County.

There is a possibility of accidents associated with off-site rail or truck transport of the liquid fuels and other products and byproducts of the proposed project. Data for rates of accidents, fatalities, and injuries from freight transport are available for individual states for trucks and railroads. Table 4.1.3 summarizes data for surface freight shipments in Pennsylvania and the U.S. The data indicate that rail shipments have significantly fewer accidents, fatalities and injuries than interstate truck shipments. Interstate truck accidents in Pennsylvania occur more frequently, and are more likely to be associated with fatalities and injuries, than the mean values for the U.S. In contrast, railroad accidents for Pennsylvania occur less frequently, and are less likely to be associated with fatalities and injuries than the mean values for the U.S. Pennsylvania's total accident rate for all truck shipments is 6.79×10^{-7} accidents/truck-km and the US median total accident rate for all shipments is 3.52×10^{-7} accidents/truck-km.

4.1.9.2 Electromagnetic Fields

The proposed facilities would tap into the existing Hauto-Frackville #3 69kV transmission line. The new generators would be connected to the 69kV line by constructing a short (less than 100-yard) 69kV interconnect from the new generators to the existing transmission line. The interconnect would operate far from any residence. Because no new transmission line would be built, no perceptible changes to existing EMF levels would occur. Consequently, EMF-related health effects, if they exist, would continue unchanged and small (NRC 1997).

4.1.9.3 Worker Health and Safety

Potential health impacts to workers during construction of the proposed facilities would be limited to the normal hazards associated with construction (i.e., no unusual situations would be anticipated that would make the proposed construction activities more hazardous than normal for a major industrial construction project). Most accidents in the construction industry result from overexertion, falls, or being struck by equipment (NSC 2003). Construction-related illnesses would also be possible (e.g., exposure to chemical substances from spills).

The Bureau of Labor Statistics reported 1,126 fatalities and 408,300 nonfatal occupational injuries and illnesses in the United States in 2003 for the construction industry (Section 3.9.3). During the same year, Pennsylvania recorded 39 construction-related fatalities. Based on the national statistics applied to an average of 516 workers on the site, the proposed project could expect 0.2 fatalities and 79 nonfatal injuries and illnesses during the 30-month period of construction.

The proposed facilities would be subject to the OSHA General Industry Standards (29 CFR Part 1910) and the OSHA Construction Industry Standards (29 CFR Part 1926). During construction and operation of the proposed facilities, risks would be minimized by WMPI's adherence to procedures and policies required by OSHA and the *Commonwealth* of Pennsylvania. These standards establish practices, chemical and physical exposure limits, and equipment specifications to preserve employee health and safety. Construction permits and safety inspections would be employed to minimize the frequency of accidents and further ensure worker safety. Construction equipment would be required

to meet all applicable safety design and inspection requirements, and personal protective equipment would be used when needed to meet regulatory and consensus standards.

Table 4.1.3. Accident, Fatality and Injury rates for trucks and railroads

Mode of transportation	Composite accident rate (10 ⁻⁷ accidents/truck- or rail car-km)	Composite fatality rate (10 ⁻⁷ fatalities/truck- or rail car-km)	Composite injury rate (10 ⁻⁷ injuries/truck- or rail car-km)
Truck transport on PA interstate highways	5.18	0.135	3.83
Truck transport on U.S. interstate highways (mean)	3.15	0.088	2.27
PA railroad transport	0.938	0.022	0.306
U.S. railroad transport (mean)	2.74	0.078	1.17

Source: Saricks and Tompkins 1999.

The Bureau of Labor Statistics reported 32 fatalities and 24,500 nonfatal occupational injuries and illnesses in the United States in 2003 for the utilities industry (Section 3.9.3). During the same year, Pennsylvania recorded no utilities-related fatalities. Based on the national statistics applied to 250 workers during operations, the proposed project could expect 0.04 fatalities and 32 nonfatal injuries and illnesses during the 36-month period of demonstration. To maximize worker safety, operations would be managed from a control room. All instruments and controls would be designed to ensure safe start-up, operation, and shut down. The control system would also monitor operating parameters and perform reporting functions. Control stations would be placed at remote locations at which operator attention would be required. Therefore, the overall design, layout, and operation of the facilities would minimize human hazards. Compliance with the Federal Occupational Safety and Health Standards, as well as safety standards specified by the *Commonwealth* of Pennsylvania and WMPI PTY, LLC, would help maintain occupational safety.

WMPI PTY, LLC, would develop supplemental detailed procedures for inclusion in the proposed facilities' Occupational Safety and Health Program to assure compliance with OSHA and EPA regulations and serve as a guide for providing a safe and healthy environment for employees, contractors, visitors, and the community. These procedures would include job procedures describing

proper and safe manners of working within the facilities (e.g., handling and storage of ammonia would comply with 29 CFR 1910.111), appropriate personal protective equipment (complying with 29 CFR 1910.132), and appropriate hearing conservation protection devices. The manual would be used as a reference and training source and would include accident reporting and investigation procedures, emergency response procedures, toxic gas rescue-plan procedures, hazard communication program provisions, material safety data sheet accessibility, medical program requirements, and initial and refresher training requirements. In addition, supplemental provisions would be added to the proposed facilities' Contingency Plan for Hazardous Waste, Spill Prevention Control and Countermeasures Plan, Hazardous Substances Response Procedures, and Air Pollution Emergency Episode Plan.

4.1.9.4 Intentional Destructive Acts

Although concerns have been raised about the vulnerability of nuclear power plants to terrorist attack (Behrens and Holt 2005), the potential for such attacks on coal-based power plants has not been identified as a threat of comparable magnitude. Nuclear materials would not be present at the proposed project, but there is the potential for release of hazardous materials in the event of an intentional destructive act (i.e., terrorism or sabotage). The potential consequences of a hazardous materials release from the proposed gasification, liquefaction, or electric generating facilities would be similar to those from accidental causes. These consequences, and measures to minimize them, are discussed in Section 4.1.9.1 above.

An intentional destructive act could also result in a disruption of power supply to the electrical grid. However, at a capacity of 41 MW, the proposed project would be a small generating unit. Temporary loss of this unit would not be expected to have a substantial effect on regional power supply. Security currently in place to protect the existing Gilberton Power Plant and the nearby Mahanoy State Correctional Institution from such acts would be expected to be sufficient to also protect the proposed project.

4.1.10 Noise

During construction of the proposed facilities, the principal sources of noise would be from construction equipment and material handling. The amount and type of construction equipment would vary depending on the specific construction activity occurring at that time (e.g., site excavation, structural steel/mechanical/electrical equipment erection and installation, piping, fabrication, etc.). Construction activity would primarily occur within 6 acres of the 75-acre main plant site.

The proposed facilities would be built next to the existing Gilberton Power Plant. To mitigate the impacts of construction noise, employees and contractors would be responsible for ensuring that exhaust mufflers and engine enclosures are in place and in good working order for all industrial trucks and other pieces of construction-related equipment. An exhaust muffler is a device that deadens the noise of escaping gases or vapors through which the exhaust gases of an internal-

combustion engine are passed. An engine enclosure silences low-frequency noise radiated from the engine. Exhaust mufflers and engine enclosures are commonly used, and are commercially available from many different manufacturers. All construction equipment would be properly maintained.

During operation of the proposed facilities, the principal sound sources would include equipment like the combustion turbine/generator, steam turbine/generator, heat recovery systems, turbine air inlets, exhaust stacks, cooling towers, pumps (e.g., feed, circulating, etc.), and compressors.

These sound sources would be enclosed and acoustically insulated. Noise sources within the buildings would be fitted with sound-attenuating enclosures or other noise dampening measures that would meet all state and federal regulations and WMPI PTY, LLC noise standards (WMPI PTY, LLC, e-mail to Robert L. Miller, ORNL, May 30, 2004). During maintenance or repair events, workers would be required to wear hearing protection equipment.

Noise levels decrease with distance from the source. There are no noise sources anticipated at the proposed facilities that could produce hearing loss 2,600 feet away. The proposed project site's highest sound level measurement was documented at 55 dB(A) in March 2003 (Section 3.10). For comparison, 55 dB(A) is the approximate level of a quiet subdivision during daylight hours. This level is also given by the EPA as a guideline upper limit with an adequate margin of safety for protection from activity interference and annoyance during the daytime in outdoor locations "in which quiet is a basis for use" (EPA 1974).

To analyze the incremental noise effects resulting from the proposed facilities, a doubling rule was used, which provides the most convenient way to perform simple arithmetic functions involving logarithmic measurements, such as dB measurements (MPCA 1999). The doubling rule provides an accurate estimate of the effect of distance and multiple sources on measured sound pressure levels. To estimate the highest sound level during simultaneous operation of the Gilberton Power Plant and the proposed facilities, the sound generated by the two facilities was assumed to be equal. According to Goodfriend and Associates (1971), power plant sound levels are similar due to comparable noise sources such as induced- and forced-draft fans, turbine generators, and air compressors. A doubling of sound energy yields an increase of 3 dB (MPCA 1999), indicating that the proposed site's highest sound level measurement would be 58 dB(A). As a basis for evaluating an increase of 3 dB, a change in sound level of plus or minus 1 dB is not perceptible to the human ear, a change in sound level of plus or minus 3 dB is the threshold of perception to the human ear, and a change of plus or minus 5 dB is clearly noticeable to the human ear (MPCA 1999).

The center of the proposed main plant would be about 2,600 ft west of the Mahanoy State Correctional Institution. The increase in noise levels (i.e., 3 dB) would probably be imperceptible because of (1) the distance between the prison and the proposed project site, (2) planned noise attenuation measures, and (3) natural and man-made terrain features and structures. No perceptible change in noise associated with the proposed facilities would be expected at the nearest *private* residence, located 3,600 ft southeast of the proposed main plant, or other offsite locations.

Increased numbers of trucks and rail traffic associated with construction and operation will generate additional noise along the transportation corridors. For example, presently the daily

traffic on State Route 61 near the proposed site averages 10,186 vehicles (Section 3.7.8.1). There would be an estimated 300-500 additional vehicle trips (for workers) and 168 truck trips (to transport raw materials and waste products) each day during operation of the proposed project (Section 4.1.7.8). Transport of the products by rail would occur once per week. Noise from this additional traffic would be more frequent, but the noise levels would be the same as presently occurs from current motor vehicle and rail traffic.

4.2 POLLUTION PREVENTION AND MITIGATION MEASURES

Pollution prevention and mitigation measures have been incorporated by WMPI as part of the design of the proposed project. The proposed facilities' use of anthracite culm as feedstock would allow reclamation of land currently stockpiled with culm and would provide a beneficial use for the material at operating mines. Also, the quality of water returned to the mine pool following use by the proposed facilities would be improved. WMPI plans to sell the coarse slag and elemental sulfur as byproducts to offsite customers. In addition, mitigation measures have been developed to minimize potential environmental impacts. Table 4.2.1 lists the pollution prevention and mitigation measures that WMPI would provide during the construction and operation of the proposed facilities.

Additional mitigation measures have been considered for the concentrated stream of CO₂ exiting the gas cleanup system (the Rectisol unit). The measures considered include the sale of the concentrated CO₂ stream and geologic sequestration of this stream. However, it has been determined that these options would not be feasible during the project demonstration phase. The industrial participant has informed DOE that sale of the CO₂ byproduct would not occur in the foreseeable future. In addition, DOE has considered the potential to reduce project CO₂ emissions using geologic sequestration. This is not a reasonable option because sequestration technology is not sufficiently mature to be implemented at production scale during the demonstration period for the proposed facilities. The future potential for geologic sequestration of CO₂ during commercial operation of the proposed facilities is discussed in Section 5.1.4.

4.3 ENVIRONMENTAL IMPACTS OF NO ACTION

Under the no-action alternative, DOE would not provide cost-shared funding to demonstrate the commercial-scale integration of coal gasification and F-T synthesis technologies to produce electricity, steam, and liquid fuels. At the site of the proposed project, it is reasonably foreseeable that no new activity would occur (Section 2.2.1). Thus, under the no-action alternative, no construction or operation of the proposed facilities would occur. No site preparation would be required, such as clearing of trees and other vegetation, site leveling, and the construction of onsite roads, parking lots, fences, and stormwater drainage areas. No employment would be provided for construction workers in the area or for operators of the proposed facilities. No resources would be required and no discharges or wastes would occur. This scenario would not contribute toward the removal of

anthracite culm, which is stacked locally in numerous piles that were set aside during previous mining of anthracite coal because of their inadequate quality.

Current environmental conditions at the site would not change. Specifically, air quality in the area would remain the same, and no changes would occur to existing geologic and soil conditions in the area. No changes would occur to the quantity and quality of surface water and groundwater and the availability of water supplies in the area. Ecological resources would remain the same. No changes would result to the current management of solid and hazardous waste in the proposed project area.

The adjacent Gilberton Power Plant would continue to operate without change. Levels of resources used and emissions, effluents, and wastes discharged would remain the same. The generation and beneficial reuse of bottom ash and other byproducts from the existing plant would continue, including the sale of bottom ash as an anti-skid material for roads and as construction fill or aggregate.

Final: October 2007

Table 4.2.1. Pollution prevention and mitigation measures developed for the proposed facilities

Environmental	developed for the proposed facilities
Environmental issue	Pollution prevention or mitigation measure
Atmospheric resources and air quality	During construction, water spray trucks would dampen exposed soil with water as necessary to minimize the occurrence of fugitive dust during construction activities.
	During site preparation, cleared vegetation and non-hazardous construction waste would be burned. The fire chief of Mahanoy Township would be notified prior to each occurrence. Open burning would <i>comply with the requirements of the Mahanoy Township Burning Ordinance and would</i> not be conducted during drought conditions in which advisories have been issued by the Pennsylvania Department of Environmental Protection.
	During construction and operation, vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions.
	To reduce particulate emissions from handling and transfer of anthracite culm, petroleum coke, and limestone, the number of handling and transfer points would be minimized, the conveyors and material unloading points would be enclosed, and wetting systems and collection devices (e.g., baghouses) would be installed.
	A very high percentage of trace elements in the synthesis gas would be removed because the integrated technologies would require extensive cleaning of the synthesis gas using wet scrubbing followed by acid gas removal using a Rectisol unit.
	Odorous emissions of hydrogen sulfide (H_2S) should not be perceptible because H_2S would be removed from the shifted synthesis gas in the acid gas removal plant using a Rectisol unit and would be converted to marketable elemental sulfur in a Claus sulfur recovery unit, a process which should remove approximately 99.99% of the sulfur from the gas stream. The gas stream exiting the Rectisol unit would be sent to a thermal oxidizer to oxidize any trace contaminants prior to being released through a stack to the atmosphere.
Geological resources	The proposed facilities would increase the removal and utilization of anthracite culm deposited on the landscape of the surrounding area, which would accelerate the ongoing process of restoring soil productivity and would help to reduce the potential for culm bank fires.
	Product rundown lines would be designed to withstand flooding and earth slides. The potential risks of product line leakage due to gradual subsidence would be reduced by inspecting product lines regularly and repairing any problems.

Table 4.2.1. Continued

	Table 4.2.1. Continued
Environmental issue	Pollution prevention or mitigation measure
Water resources	During construction, standard engineering practices such as silt fencing, straw bales, and revegetation of graded areas would be implemented to control runoff, erosion, and sedimentation that could affect other watersheds.
	Accidental spills of construction materials such as solvents, paint, caulk, oil, and grease that could contain hazardous substances would be cleaned up in a timely manner and in accordance with a Spill Prevention, Control, and Countermeasure Plan and Best Management Practices Plan, thus minimizing the potential for overland flow into streams.
	The Pennsylvania <i>Department of Environmental Protection</i> would be able to reduce by approximately 39% its pumping of water from the Gilberton mine pool to Mahanoy Creek to control the mine pool elevation.
	Discharge of treated effluent to the mine pool would be expected to reduce concentrations of acidity and dissolved metals in the mine pool, and thus also in the water pumped to Mahanoy Creek from the mine pool.
	Most potential impacts to groundwater quality on Broad Mountain would be avoided by implementing standard engineering practices, including collection of potentially contaminated runoff and cleaning up accidental spills in a timely manner. The proposed septic system would be designed and operated in accordance with permitting requirements and would only receive wastewaters similar to those generated by households.
Ecological resources	Excavated areas surrounding the proposed facilities would be reseeded following construction, and compatible areas would be allowed to revert to forested conditions.
	During reclamation of culm banks, the land surface would be graded to minimize erosion, and vegetation would be established. Over the long term, the terrestrial habitat created on reclaimed lands would offset the 76.5 acres of deciduous forest that would be cleared for the proposed facilities.
Traffic and transportation	Additional construction- and operations-related traffic, which would affect traffic flow and safety on State Route 61 and State Route 1008, could be mitigated by signaling, road widening, or scheduling work hours and/or deliveries to avoid periods of heavy traffic.
	WMPI would consult with the PennDOT on minimizing noise, dust, and traffic congestion impacts to residents along the transportation corridor and providing mitigation for the project's impacts on local road maintenance and repair.

	Table 4.2.1. Continued
Environmental	
issue	Pollution prevention or mitigation measure
Waste management (solid)	Excess supplies of new materials would be returned to vendors, retained by the facilities for future use, or transferred in settlement with subcontractors (who could retain the items for use in future projects). Surplus paint and other consumables, partial spools of electrical cable, and similar leftover materials would also be retained for possible future use in maintenance, repairs, and modifications.
	Metal scrap not suitable for future use in the facilities would be collected for resale to scrap dealers or recyclers.
	The gasifier slag would be marketed for sale. Potential uses include lightweight construction aggregate, asphalt roofing shingle granules, blasting grit, and pipe bedding material. Any slag not used commercially would be used as fill material for mine reclamation. Compliance with 25 Pennsylvania Code Chapter 287 would minimize the potential for adverse impacts to water quality from beneficial reuse of slag and other byproducts.
	Some fine solid material could be captured and returned to the gasifier for energy recovery. The majority of the material would be placed on WMPI land that is permitted for disposal of coal byproducts as part of mine reclamation.
	Sludges from treatment of raw water and wastewater would be placed on WMPI land that is permitted for disposal of coal byproducts as part of mine reclamation.
	Sulfurous compounds would be converted during processing to marketable elemental sulfur.
	The proposed facilities' solid wastes and byproducts would not likely be hazardous as defined under RCRA. The EPA's Toxicity Characteristic Leaching Procedure test would be performed to verify this. Any wastes subject to RCRA hazardous waste regulations would be handled in accordance with standard procedures similar to those currently employed at the Gilberton Power Plant.
Waste management (liquid)	Potential impacts from odor would be controlled by treating all process wastewater within enclosed facilities prior to discharge to the final equalization basin.
	The potential for upsets in biological treatment units could be minimized by designing the system with ample reserve capacity, selecting treatment units that are demonstrated to tolerate a wide range of wastewater characteristics, and controlling inflows to the treatment system to maintain consistent wastewater characteristics.

Potential for explosion in oil-water separation units could be minimized by using a nitrogen gas blanket over these units.

Table 4.2.1. Concluded

Environmental issue	Pollution prevention or mitigation measure
Worker health and safety	During construction and operation, risks would be minimized by WMPI's adherence to procedures and policies required by OSHA and the <i>Commonwealth</i> of Pennsylvania. These standards establish practices, chemical and physical exposure limits, and equipment specifications to preserve employee health and safety.
Noise	Employees and contractors would be responsible for ensuring that exhaust mufflers and engine enclosures are in place and in good working order for all industrial trucks and other pieces of construction-related equipment. During operation, the principal sound sources (i.e., combustion turbine/generator, steam turbine/generator, heat recovery systems, turbine air inlets, exhaust stacks, cooling towers, pumps, and compressors) would be
	enclosed and acoustically insulated. Noise sources within the buildings would be fitted with sound-attenuating enclosures or other noise dampening measures that would meet all state and federal regulations.
	During maintenance/repair events, workers would be required to wear hearing protection equipment.
	WMPI would also work with the PennDOT to minimize impacts to residents along the transportation corridor and to provide mitigation for the project's impacts on local road maintenance and repair.